Transactions of the Society of Medical Officers of Health.

Session 1885-86.

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FOR THE PROMOTION

OF HEALTH

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J. Pleydell Wilton, M.R.C.S., 10, College-green, Gloucester ... ... *Gloucester U.S.A. and Port.*

W. C. Wise, M.D., C. San. Sci. Camb., Gothic Lodge, Plumstead ... ... *Plumstead.*

W. D. Wood, L.R.C.P.Edin., 50, St. John-street, Oxford ... ... *Bicester, Chipping Norton, Henley, Woodstock R. and U.S.D.*

W. T. G. Woodforde, M.D., Oakbank, Spencer's Wood, Reading ... ... *Berkshire.*

A. Woodward, M.R.C.S., Bloomfield, Ryde, Isle of Wight ... ... *Ryde and St. Helen's U.S.A.*

G. E. Yarrow, M.D., 87, Old-street, E.C. ... *St. Luke's.*

ASSOCIATES.

E. Bayley, M.A., 36, Queen's-gate-terrace, S.W.

A. J. Bernays, M.A., F.C.S., Acre House, Brixton Rise, S.W.

W. J. V. Bindon, M.D., D.Sc. (*Address not known.*)

W. A. S. Bridgeford, M.R.C.S., St. Pancras Infirmary, N.

A. Carpenter, M.D., 5, Grosvenor-street, W.

C. E. Cassal, F.C.S., 35, Castlebar-road, Ealing, W.

A. Collie, M.D., Eastern District Hospital, Homerton, E.

J. E. Cooney, L.R.C.P.Edin., C. San. Sci. Camb., 20, Vereker-road, West Kensington, S.W.

W. Crookes, F.R.S., F.C.S., 7, Kensington Park-gardens, W.

W. Eassie, C.E., 11, Argyll-street, Regent-street, W.

F. East, M.D., 2, Clapton-square, E.

J. J. Eyre, M.R.C.S., Vega House, Forest Hill, S.E.

A. Fergus, M.D., F.F.P.S.Glasg., 191, Bath-street, Glasgow.

Rogers Field, M.I.C.E., 4, Westminster-chambers, Victoria-street, S.W.

W. J. Gibbon, A.R.I.B.A., 3, Verulam-buildings, Gray's Inn, W.C.

Ernest Hart, M.R.C.S., 38, Wimpole-street, W.

Thos. Hawksley, C.E., 30, Great George-street, Westminster, S.W.

G. A. Heron, M.D., 57, Harley-street, W.

F. J. Hicks, M.D., 30, George-street, Hanover-square, W.

N. A. Humphreys, Esq., General Register Office, Somerset House.

C. Innes, C.E., 1, Adam-street, Adelphi, W.C.

Mark Judge, A.R.I.B.A., 8, Park-place-villas, Paddington, W.

W. R. Kemp, 18, Talfourd-road, Peckham, S.E.

W. Barnes Kinsey, 9, Carteret-street, Queen Anne's-gate, Westminster, S.W.

A. Lingard, M.R.C.S., 49, Lambeth Palace-road, S.E.

G. B. Longstaff, M.B., Southfield Grange, West-hill-road, Wandsworth, S.W.

J. A. D. Mackey, B.A.(Oxon.), 1, Westbourne-terrace, W.

J. B. Mackey, 2, Bouverie-street, E.C.

Louis Parkes, M.D., C. San. Sci. Lond., 51, Cadogan-square, S.W.

C. Renner, M.D., 80, Portsdown-road, Maida-vale, W.

EDWARD C. ROBINS, F.R.I.B.A., 14, John-street, Adelphi, W.C.
W. R. SMITH, M.D., C. San. Sci. Camb., 74, Great Russell-street, W.C.
H. SAXON SNELL, F.R.I.B.A., 22, Southampton-buildings, W.C.
A. SPENCER, Metropolitan Board of Works, Spring-gardens, W.
J. SYMONDS, M.D., High-street, Tutbury, Staffordshire.
ERNEST TURNER, F.R.I.B.A., 246, Regent-street, W.
Prof. R. V. TUSON, Royal Veterinary College, Camden-town, N.W.
GEORGE WALLACE, C.E., 197, High Holborn, W.C.
W. WEAVER, C.E., Vestry Hall, Kensington, W.
CHARLES WEST, M.D., 55, Harley-street, W.
W. WYNN WESTCOTT, M.B.Lond., 4, Torriano Avenue, N.W.
W. WHITAKER, B.A., C. San. Sci. Camb. and Lond., 33, East Park-terrace, Southampton.
E. F. WILLOUGHBY, M.D., Bratton Lodge, Green-lanes, N.
E. T. WILSON, M.B., F.R.C.P.Lond., Westal, Cheltenham.
W. H. WOODRUFFE, A.R.I.B.A., Charnwood, New Malden, Surrey.

SOCIETY

OF

MEDICAL OFFICERS OF HEALTH.

BY-LAWS.

OBJECTS.

The objects of the Society are (*a*) the advancement of sanitary science, (*b*) mutual assistance in the performance of the duties of Medical Officers of Health.

CONSTITUTION.

Members.

All acting or retired Medical Officers of Health are eligible for election as Members.

Honorary Members.

Distinguished persons known to interest themselves in matters relating to public health are eligible, on nomination by the Council, for election as Honorary Members.

Associates.

Gentlemen not being Medical Officers of Health, but interested in the promotion of sanitary science, are eligible for election as Associates.

ELECTION OF MEMBERS AND ASSOCIATES.

Candidates for election as Members or Associates shall be proposed in writing by two members at any ordinary or annual meeting, and shall be balloted for by the Members present at the following meeting. The names of candidates shall be announced in the notice convening the meeting at which the ballot is to take place, and no candidate shall be elected unless four-fifths of those voting shall be in favour of the election.

ELECTION OF HONORARY MEMBERS.

The names of persons nominated by the Council for election as Honorary Members shall be announced in the notice convening the meeting at which the ballot is to take place, and no person shall be elected unless four-fifths of the Members voting shall be in favour of the election.

SUBSCRIPTIONS.

Members acting within the Metropolitan area shall pay an entrance-fee of one guinea and an annual subscription of one guinea.

Members acting without the Metropolitan area shall pay an annual subscription of half-a-guinea.

Retired Medical Officers of Health shall pay an annual subscription of half-a-guinea.

Associates shall pay an annual subscription of half-a-guinea.

Subscriptions, payable in advance, shall be due on the first day of October in each year, and in the case of new Members and Associates, within one month after election. Any Member or Associate neglecting to pay his subscription longer than twelve months after it shall have become due, shall be liable to have his name removed from the roll of the Society, and anyone not having paid his subscription for two years shall cease to belong to the Society.

PRIVILEGES OF HONORARY MEMBERS AND ASSOCIATES.

Honorary Members and Associates shall have the privilege of attending ordinary and special meetings, and of taking part in the discussions; but they shall not vote on any subject affecting the constitution, the management, or the discipline of the Society.

GENERAL MANAGEMENT.

The General Management of the Society shall be vested in a Council which shall consist of the Officers and of twelve Members, six of whom shall be Medical Officers of Health acting without the Metropolis. Three shall form a quorum.

The Officers of the Society shall consist of a President, four or more Vice-Presidents, a Treasurer, and two Secretaries.

The election of Officers and of other Members of the Council shall take place at the annual meeting, except in the case of vacancies arising from any cause, when a special meeting may be called for the purpose of filling such vacancies. Election shall be by ballot from Members of the Society duly proposed and seconded.

The Council shall consider and report on all matters referred to it; it shall also audit the Treasurer's account previous to the Annual Meeting.

The President, the Secretaries, or any three Members of the Council, shall have the power of calling a meeting of the Council.

Committees for the consideration of special subjects may be appointed by the Society or by the Council.

The Officers shall be *ex officio* members of all Committees.

Meetings.

The annual meeting shall be held on a day to be previously fixed by the Council. At least seven days' notice of such meeting shall be given. Seven Members shall form a quorum.

The ordinary meetings shall be held at 7.30 P.M., on the third Friday in each month, from October to May inclusive. Seven Members shall form a quorum.

Special meetings may be convened by the President, the Secretaries, or on a requisition signed by five Members of the Society. Ten Members shall form a quorum.

The notice convening any meeting shall specify the business to be be transacted thereat.

The President, if present, shall take the chair; in his absence it shall be taken by one of the Vice-Presidents. In the absence of the President and Vice-Presidents at the time fixed for the meeting, the Members present shall elect a chairman.

The Chairman shall determine what subjects other than those placed on the notice paper may be discussed at an ordinary or annual meeting.

Without the permission of the Chairman, no one taking part in the discussion of a paper shall speak more than once, or for a longer period than ten minutes.

All questions shall be decided by a majority of votes on a show of hands, and in case of an equality the Chairman shall have a casting vote.

The discussion of any subject may be adjourned to the next or any subsequent meeting.

Visitors may be introduced at any meeting other than an Annual Meeting either by a Member or by an Associate, and may take part in the discussions thereat.

The order of business at the annual meeting shall be as follows :—

Chair taken.
Minutes of last Annual Meeting.
Reports of Council and Committees.
Correspondence.
Treasurer's Annual Report.
Secretaries' Annual Report.
Election of Officers.
Members and Associates proposed.
Election of Members, Honorary Members, and Associates.
Miscellaneous business.

The order of business at ordinary meetings shall be as follows :—

Chair taken.
Minutes of last meeting.
Reports of Council and Committees.

Correspondence.
Members and Associates proposed.
Election of Members, Honorary Members, and Associates.
Miscellaneous business.
Papers read at 8 o'clock.

The time for the transaction of miscellaneous business may, by the vote of the meeting, be extended for a period not exceeding fifteen minutes.

The order of business at a special meeting shall be as follows :—

Chair taken.
Business specified on notice paper.

RESIGNATION OF MEMBERS.

Any Member desiring to withdraw from the Society shall signify the fact in writing to the Secretaries, but he shall be liable to pay whatever be due from him at the time of his withdrawal.

REMOVAL OF MEMBERS.

Whenever in the opinion of the Council there shall appear cause for the removal of any Member, Honorary Member, or Associate from the Society, a statement of the circumstances shall be prepared by the Council and a copy of it shall be forwarded to the Members with the notice summoning the special meeting at which it is to be considered. On the question of such removal being put to the ballot, and on four-fifths of the members present voting for it, at least ten, including the Chairman, being present, the Chairman shall declare the Member, Honorary Member, or Associate to have been removed from the Society. Any one thus removed shall not be eligible for re-election except on the written nomination of six Members.

ALTERATIONS IN BY-LAWS

Notice of any proposed alteration in the by-laws shall be sent by post to each Member at least seven days before the meeting at which the proposed alteration is to be considered.

Revised, January 1885.

SECRETARIES' ANNUAL REPORT

FOR THE SESSION 1885-86.

The work of the Society has progressed most satisfactorily during the year. Altogether fifteen meetings were held, viz., the Annual Meeting, eight Ordinary Meetings, and seven Council Meetings.

The Society added largely to its strength during the Session, one honorary member, thirty-one members, and five associates having been elected. Its losses were one honorary member and three members by death, and three members by resignation.

Subjoined is a list of members and associates elected:—

Honorary Member.

E. Klein, M.D., F.R.S.

Members.

M. A. Adams, F.R.C.S., Maidstone U.S.A.
H. J. Alford, M.D., Taunton R. and U.S.A.
P. Boobbyer, M.B., Basford R.S.A.
J. B. Bromley, M.R.C.S., Halstead Union R.S.A.
G. Brown, M.D., Colchester U.S.A.
G. H. Browne, L.R.C.P., Brynmawr.
A. Buncle, M.B., Pontefract and Featherstone U.S.A.
J. Clark, M.D., Lichfield R.S.A.
G. H. R. Dabbs, M.D., Shanklin U.S.A.
M. A. Fenton, M.D., Coventry U.S.A.
T. Fowler, L.K.Q.C.P.Irel., Epping R.S.A.
J. B. Fry, L.R.C.P., Swindon U. and R.S.A.
J. Groves, M.B., Isle of Wight R.S.A.
H. Jackson, M.R.C.S., Barnstaple U. and R.S.A.
W. J. Keir, F.R.C.S., Melksham R. and U.S.A.
W. H. Kempster, M.D., East Battersea M.O.H.
J. Morton, M.B., Guildford U.S.A.
J. W. Norman, F.R.C.S., Ross R. and U.S.A.
P. W. G. Nunn, L.R.C.P., Bournemouth U.S.A.
C. A. Patten, L.R.C.P., Ealing U.S.A.
W. Rendall, M.R.C.S., Dorset R.S.A.
F. V. Sandford, M.D., Hereford U. and R.S.A.

J. C. Sanger, M.D., West Firle R.S.A.
J. J. Skegg, L.R.C.P., St. Martin's-in-the-Fields M.O.H.
J. W. Taylor, M.D., Scarborough U.S.A.
W. Tyrrell, M.R.C.S., Great Malvern R.S.A.
F. Vacher, F.R.C.S., Birkenhead M.O.H.
W. Verdon, F.R.C.S., Lambeth M.O.H.
C. Wills, M.R.C.S., Southwell and Worksop R.S.A. and Mansfield U.S.A.
J. P. Wilton, M.R.C.S., Gloucester U.S.A, and Port.
A. Woodward, M.R.C.S., Ryde and St. Helen's U.S.A.

Associates.

W. A. S. Bridgeford, M.R.C.S., St. Pancras Infirmary, Dartmouth Hill, N.
J. E. Cooney, L.R.C.P., 20, Vereker Road, West Kensington.
W. J. Gibbon, A.R.I.B.A., 3, Verulam Buildings, Gray's Inn.
A. Lingard, M.R.C.S., 49, Lambeth Palace Road, S.E.
W. H. Woodruffe, A.R.I.B.A., Charnwood, New Malden, Surrey.

Deceased.

J. S. Burton, M.R.C.S., Blackheath.
Gavin Milroy, M.D., 21, Church Road, Richmond.
W. C. Morris, M.B. Edin., Chester-le-Street, Durham.
E. J. Syson, L.R.C.P.Ed., St. Ives, Hants.

Resigned.

J. S. Walker, M.D., Hanley, Staffordshire.
F. E. Wilkinson, M.D., Sydenham, S.E.
S. M. Wilson, M.R.C.S., King's Lynn, Norfolk.

The roll of the Society now includes twenty-two honorary members, one hundred and eighty-six members, and forty-five associates.

Dr. W. H. Corfield succeeded Dr. T. Orme Dudfield as President, and delivered an Inaugural Address on the History of House Sanitation.

The following papers were read during the Session:—"Dr. Koch's Comma Bacillus", by Dr. G. A. Heron; "Recommendations of the Royal Commission on the Housing of the Working Classes as they affect the Status of the Medical Officer of Health", by Dr. E. C. Seaton; "The Suction of Sewer Gas into the Water-Supply, a fertile Source of Enteric Fever", by Dr. Horace Swete; "The Supervision of the Milk-Supply of the Metropolis in reference to the Propagation of Disease", by Messrs. Wynter Blyth and Alfred Spencer; "The Sanitary Condition of Poor Districts in the Metropolis, with especial reference to their Water-closet Accommodation", by Dr. Parkes; "Dr. Koch's Gelatin-Peptone Test for Water", by Professor G.

Bischof; "The Waters derived from the Bagshot Beds considered as Drinking Supplies", by Mr. W. Eassie, C.E.

Among the subjects specially considered by the Society during the Session was the Dairies, Cowsheds, and Milkshops Order of 1885. The Society were glad to note in this Order that what previously were mere provisions, are now made distinct regulations. It was also observed that the Metropolitan Board of Works, the Local Authority under the Act, had included among their regulations the following, requiring the notification of infectious disease by purveyors of milk, and persons selling milk by retail:—

> "Every purveyor of milk, or person selling milk by retail, shall, immediately on any outbreak of infectious or contagious disease within the building, or upon the premises in which he keeps his milk, or amongst the persons employed in his business, give notice of such outbreak to the Board at their Office in Spring Gardens."

The Society felt that such information would be of much value to Metropolitan Medical Officers of Health, and therefore instructed their secretaries to address a letter to the Board, asking for such information to be given. In reply thereto a letter was received, stating that the Board had given instructions that any outbreak of infectious disease upon the premises of a milk dealer, or amongst the persons in his employ, which may come to the knowledge of the Board, either by means of a notice under Regulation 28, or through a report of one of the Board's inspectors, should be communicated to the Medical Officer of the district.

Another subject relating to infectious disease in the metropolis also came under the notice of the Society. The Metropolitan Asylums Board had addressed a letter to the Vestries and District Boards, inviting the latter to contract with the managers for the reception into their hospitals of cases of infectious disease occurring amongst persons who were not paupers. The subject was discussed at some length, but eventually no resolution was adopted.

The Society also had before them, on the motion of their President, the desirability of the creation of a national laboratory for the study of bacteriology and other methods of hygienic research. The Society passed a resolution to the effect, that such a laboratory was desirable, and also resolved to empower the Council to appoint a Committee to put itself in communication with the Councils of other Societies to take into consideration the best way of giving effect to the resolution. A Committee was subsequently appointed.

The London School Board, having sought the advice of Metro-

politan Medical Officers of Health as to the sufficiency of the Board's regulations for preventing the spread of infectious disease amongst school-attending children, and as to the necessity for excluding from attendance children suffering from mumps, and children coming from a house in which cases of whooping-cough existed, it was resolved that the following letter be communicated to the Board :—

Copy of Letter addressed to the London School Board.

"Society of Medical Officers of Health.

"Scottish Corporation Hall,
Crane Court, Fleet Street, E.C.
"*April* 1886.

"Sir,—The Society of Medical Officers of Health have had under consideration a letter addressed to their Metropolitan members by your Board, asking for information concerning certain infectious diseases, viz., mumps and whooping-cough, and as to the Board's regulations generally in respect to other infectious diseases.

"In view of the importance of the subject, the Society have deemed it desirable to offer a collective reply to the letter ; and we are instructed to submit the following observations :

"The Society are of opinion that a child, if suffering itself from mumps, should be excluded from school ; but it is not necessary to prohibit the attendance of a healthy child coming only from an infected house. Again, in the case of whooping-cough, if a child itself is suffering from this disease, it ought certainly to be excluded ; but having regard to the fact that the danger from the disease is not so great at school-attending ages, the Society would not prohibit the attendance of healthy children coming from infected families.

"The Society, while believing that an elementary knowledge of the symptoms of infectious disease may be of use in enabling school teachers to exclude children having marked signs of such disease, think that no regulations can be trusted to replace medical inspection of children, and therefore desire to express no opinion as to the sufficiency of those regulations adopted by the Board for this purpose.

"The Society regret to find that Metropolitan Medical Officers of Health generally have not received notification of cases of infectious disease from teachers and visitors, as the regulations of the School Board appear to require.

"We are, Sir,

"Your obedient servants,

"Shirley F. Murphy,
"C. E. Saunders, M.D., } *Hon. Secs.*

"G. H. Croad, Esq., B.A.,
"*Clerk to the London School Board.*"

Since the issue of the last volume of the *Transactions* a case of much importance to Sanitary Authorities has been the subject of litigation, and the Secretaries are of opinion that it deserves to be fully stated. They therefore reproduce here a report of the case.

QUEEN'S BENCH DIVISION, Nov. 11, 1885.

(*Sittings in Banco, before* Mr. Justice Day *and* Mr. Justice A. L. Smith.)

WHITAKER V. DERBY URBAN SANITARY AUTHORITY.

This was a case stated under 20 and 21 Vict., cap. 43, by two justices for the borough of Derby for the opinion of this Court. On January 8, 1885, a complaint was preferred by the Derby Urban Sanitary Authority, the respondents, against the appellant, under section 96 of the Public Health Act, 1875 (38 and 39 Vict., cap 55), that he, being the owner of certain premises in the said borough, did permit a nuisance to exist on them—to wit, the privies and cesspools which were close to the houses, so as to be a nuisance and injurious to health. The justices made an order that the appellant should deodorize and fill in the privies and convert them into proper pan water-closets and connect them with the main drains, so that the same should no longer be a nuisance or injurious to health. The appellant, being dissatisfied with this determination, applied to the justices to state a case for the opinion of this Court, which they had accordingly done. One of the facts stated to have been found in the case by them was that the work ordered by them to be executed by the appellant was the only satisfactory means of abating the nuisance and preventing its recurrence. It was submitted before the justices by the appellant that they had no power to prescribe the precise mode in which the alleged nuisance should be abated by him, and consequently also none to make their order against him in the terms in which it had been made, in support of which contentions "Ex parte Whitchurch" ("L.R." 6, Q. B. D., 545) and "Ex parte Saunders" ("L.R." 11, Q. B. D., 191) were relied upon by him. The respondents' contention before the justices was that the order as made was a proper one under section 96 of 38 and 39 Vict., cap. 55, and Schedule IV, Form C, of that statute, and they relied upon "Ex parte Llewellyn" ("L.R." 13, Q. B. D., 681).

Mr. W. Graham, for the appellant, said that this case raised the question as to whether or not the decision in "Ex parte Whitchurch" (*sup.*) was right. The latest case on the subject was that of "The Queen v. Justices of Kent" (1 *The Times Law Reports*, 539), where all question as to that part of the order of the justices, which by the ruling in "Ex parte Whitchurch" had been decided to be invalid, had been expressly abandoned by the then appellant. The present appellant did not so much complain of the order to execute the works, but contended that it could not be made under the provisions of the statute in question if the words "or otherwise to abate the nuisance" were, as they had in fact been in this case, omitted. If the order were valid, it would be out of the power of anybody in such a case to comply with one by doing away with a dwelling-house as such altogether where the alleged nuisance was by converting it into a warehouse or pulling it down, though in such case the work ordered to be executed would be wholly thrown away.

Mr. Justice Day: You would substantially have obeyed the order if in that way you had done away with the nuisance here, and would no doubt have heard no more of the matter, but the appellant had never told the magistrates of any intention on his part to pull down the premises or convert them into a warehouse.

Mr. Graham said that the appellant had been quite prepared to have abated the nuisance in his own way, which was all that the justices had power to order him to do. Section 36 of the Public Health Act, 1875, gave power to a local authority to enforce its provisions for the privy accommodation to houses, and the order in this

case ought to have been made under that section. The appellant could then have appealed to the Local Government Board against it.

Mr. JUSTICE DAY said that by section 96 justices could order works to be done in compliance with the requisitions of a notice, "or otherwise to abate the nuisance." That was an alternative given to the justices.

Mr. LUMLEY, for the respondents, pointed out that the case of "The Queen v. Justices of Kent" was a direct authority that justices in such cases could order the execution of particular works.

Mr. GRAHAM then further addressed the Court in support of the appeal.

Without calling on the other side,

Mr. JUSTICE DAY said that the case of "Ex parte Whitchurch" was an authority for saying that where an order was to be made for structural alterations proceedings should be taken under section 36 and not under section 96. Where a nuisance injurious to health existed it was of the utmost importance that it should be suppressed, and the question as to how it was to be abated was one for discussion before the justices only. The provisions of the Public Health Act, 1875, from section 91, contemplated existing nuisances, and were of the utmost value from the protection which they gave to public health. If the justices were satisfied that the alleged nuisance existed they could require the person complained of to comply with any as distinguished from all of the requisitions contained in the notice "or otherwise to abate the nuisance". They had absolute jurisdiction to order what they might deem necessary to be done to put an end to the nuisance—by any means contained in the notice or otherwise which might appear to them to be necessary. They were clearly not bound to add to their order words which would allow the person complained of to do only anything which he might think fit to abate the nuisance. The order appealed against was clearly a valid one, by which the justices had required nothing more to be done than had been necessary.

Mr. JUSTICE A. L. SMITH, in concurring, said the appellant complained of the order against him to abate a nuisance by executing certain works specified in that order, and that it was bad because there was no power given by it to him to abate the nuisance in any way which he might think proper. In "Ex parte Whitchurch" it had been held that justices had no power under section 96 to order structural alterations, but only under section 36. There no question had been raised as to whether the order ought to have been in the alternative, nor had it been raised in "Ex parte Saunders". In the last-named case he (the learned Judge) and Mr. Justice Cave had felt much difficulty owing to the decision in "Ex parte Whitchurch", but they had distinguished it on the ground that the justices had not there ordered absolutely new privies to be constructed, and had so been able to uphold the order for the execution of structural alterations. In the case of "The Queen v. Llewellyn", Mr. Justice Mathew and Mr. Justice Day had extended the doctrine laid down in "Ex parte Saunders", and also upheld an order made by justices for structural alterations. No argument as to an alternative order was raised there or in the case of "The Queen v. Justices of Kent". That case had first come before Mr. Justice Hawkins and himself, and, inasmuch as there could be no appeal in such matters, and there were conflicting decisions by Courts of co-ordinate jurisdiction upon the point, it had been ordered that the arguments in it should be taken before three Judges. Mr. Justice Field, Mr. Justice Manisty, and Mr. Justice Wills had in that case practically dissented from the decision in "Ex parte Whitchurch" in holding that the justices had had power, under section 96, to order structural alterations, and negatively it had been decided by them

that the justices were not obliged to give an alternative to the person complained of, so that he might abate the nuisance in his own way. This appeal must clearly be dismissed with costs.

Mr. GRAHAM asked that costs might not be allowed, on the ground that at the date at which the special case had been applied for the decision in "The Queen v. Justices of Kent" had not been given.

Mr. JUSTICE A. L. SMITH said that the appellant had chosen to rely upon the decision in "Ex parte Whitchurch" as against those in the other cases, and must take the consequence of having done so.

Appeal accordingly dismissed with costs.

But little attention was given in Parliament during the year to the health requirements of the country, the only two important legislative measures being the Housing of the Working Classes Act (1885) and the Contagious Diseases (Animals) Act (1886).

The former placed upon Local Sanitary Authorities the statutory duty of putting in force from time to time, as occasion may require, the powers with which they are invested, so as to secure the proper sanitary condition of all premises within the area under the control of such Authority. This principle has always been recognised by Health Officers and the more active members of Local Authorities, and it is a source of much satisfaction to all interested in the public health to find that it is at length definitely recognised by the legislature. It is probable that this amendment of the general sanitary law will in the future assume a very practical value when injury can be shown to result from the neglect of any such Authority to exercise the powers of which they are possessed.

Much of the Act is devoted to an amendment of the Labouring Classes' Lodging Houses Acts. These Acts have been hitherto practically a dead letter; it is now enacted that they may be adopted in their respective districts by the Commissioners of Sewers of the City of London; by the Metropolitan Board of Works, if one of Her Majesty's principal Secretaries of State approves of such adoption; by Urban Sanitary Authorities, in accordance with Section 10 of the Public Health Act, 1875, and by Rural Sanitary Authorities, upon certificate published by the Local Government Board; but these Acts must not be adopted except under emergency until the ordinary election of members of such Authority, which is held next after the date of the local inquiry by the Local Government Board which precedes the publication of the certificate. Power is also given to the Local Government Board after inquiry, and on the application of the Local Authority, to impose the burden of the expenses of the

execution of these Acts upon some contributory place or places only in their district instead of upon the whole district.

The expression "Lodging-houses for the Labouring Classes" in the Acts of 1851 and 1867 is now deemed to include "separate houses or cottages for the Labouring Classes, whether containing one or several tenements, and the purposes of the Act shall be deemed to include the provision of such houses and cottages."

The Artisans and Labourers' Dwellings Improvement Acts of 1875 to 1882 are amended by making them extend to all Urban Sanitary Districts. Moreover, in the Metropolis (exclusive of the City of London), one of Her Majesty's principal Secretaries of State is empowered to appoint an arbitrator whenever a Local Authority is of opinion that the demolition of premises reported in pursuance of the Artisans and Labourers' Dwellings Act of 1868, or of Section 8 of the Artisans' Dwellings Act of 1882, would be of general importance to the Metropolis as a whole, and the Secretary of State, after receiving a report from the Arbitrator, may order that it should be dealt with by a scheme under the Artisans and Labourers' Dwellings Improvement Acts 1875 to 1882. And again, where a representation has been made under the Act of 1875, and the Metropolitan Board of Works resolve that the case is not of general importance to the Metropolis, the Secretary of State may order that it should be dealt with under the Artisans' Dwellings Acts 1860 to 1882.

With regard to houses let in lodgings: under Section 90 of the Public Health Act of 1875, the Local Government Board can declare this section to be in force within the district of a Sanitary Authority. It is now enacted that this declaration shall be unnecessary, and every Sanitary Authority shall have power to make by-laws for the matters specified in this section.

Powers are also conferred upon Sanitary Authorities to make by-laws for promoting cleanliness in, and the habitable condition of tents, vans, sheds, and similar structures used for human habitation, and for preventing the spread of infectious disease by the persons inhabiting the same, and generally for the prevention of nuisances in connection with the same.

The Contagious Diseases (Animals) Act, 1886, transferred to the Local Government Board the powers conferred upon the Privy Council by Section 34 of the Act of 1878, of making general or special orders—

1. For the registration with the Local Authority of all persons

carrying on the trade of cowkeepers, dairymen, or purveyors of milk.

2. For the inspection of cattle in dairies, and for prescribing and regulating the lighting, ventilation, cleansing, drainage, and water-supply of dairies and cowsheds in the occupation of persons following the trade of cowkeepers or dairymen.

3. For securing the cleanliness of milk stores, milk shops, and of milk vessels used for containing milk for sale by these persons.

4. For prescribing precautions to be taken for protecting milk against infection or contamination.

5. For authorising a Local Authority to make regulations for the purposes aforesaid.

The Act of 1886 also constituted as Local Authorities the various Sanitary Authorities in all parts of England but in the Metropolis. The Council, after consideration of the Bill, were of opinion that in the Metropolis the Sanitary Authorities should be associated with the Metropolitan Board of Works in the duty of enforcing the regulations made under this section, leaving to the latter Board the duty of determining what these should be; and, further, they were of opinion that any such regulations should, in view of Mr. W. H. Power's recent observations, be made to extend to the prevention of infection of milk due to any condition of the cow, and not simply be limited to milk-infection after the secretion had left the body of the animal. Steps were taken to place these views before those who had charge of the Bill, but, unfortunately, it was found impossible to modify any of its provisions, owing to the hurried termination of the Parliamentary session. This Act will, it may be anticipated, lead to an improvement of the conditions under which cattle will be kept, and efforts for its amendment will probably meet with greater success when further knowledge is gained in the direction indicated by Mr. Power's observations.

During the session the Society deemed it desirable that arrangements should be made for the better accommodation of the Society, and, after some inquiry had been made as to the suitability of various places of meeting, determined to return to their former place of meeting at the Scottish Corporation Hall, Crane Court, Fleet Street, —a change which, there is reason to believe, has given universal satisfaction.

The Annual Meeting of the Society was held at the Holborn Restaurant on July 8th, the members and their friends subsequently dining together. At this meeting the following gentlemen were elected as office-bearers for the ensuing session, 1886-87 :—

President.

ALFRED HILL, M.D.

Vice-Presidents.

H. E. ARMSTRONG, M.R.C.S.
A. WYNTER BLYTH, M.R.C.S.
W. H. CORFIELD, M.A., M.D.
T. ORME DUDFIELD, M.D.
CHARLES KELLY, M.D.
EDWARD SEATON, M.D.

Treasurer.

S. R. LOVETT, L.R.C.P.E.

Hon. Secretaries.

SHIRLEY F. MURPHY.
C. E. SAUNDERS, M.D.

Council.

W. ARMISTEAD, M.B.
ALFRED ASHBY, M.B.
J. S. BRISTOWE, M.D., F.R.S.
G. BUCHANAN, M.D., F.R.S.
H. BUTTERFIELD, M.R.C.S.
W. COLLINGRIDGE, M.D.
CONWAY EVANS, M.D.
SEPTIMUS GIBBON, M.D.
E. GWYNN, M.D.
J. ROWLAND, M.D.
J. SHEA, M.D.
W. T. G. WOODFORDE, M.D.

The Treasurer's accounts were presented to the Meeting. The Balance Sheet, which had been audited and found correct by Mr. Wynter Blyth and Dr. C. E. Saunders, shewed that the Subscriptions and Entrance Fees received during the session amounted to £145 17*s.*, while a further sum of £1 2*s.* 6*d.* was received from the sale of the Society's *Transactions*. The disbursements amounted to £139 15*s.* 8*d.*, including the payment to the Treasurer of £6 17*s.* 9*d.*, due at the end of the previous session, leaving a balance of £7 3*s.* 10*d.* in favour of the Society.

SHIRLEY F. MURPHY,
C. E. SAUNDERS, M.D., } *Hon. Secs.*

July 1886.

FINANCIAL STATEMENT OF THE SOCIETY OF MEDICAL OFFICERS OF HEALTH.

Receipts and Expenditure from July 1st, 1885, to June 30th, 1886.

S. R. LOVETT, L.R.C.P., Treasurer.

Dr. CASH.

	£	s.	d.
To subscriptions, entrance fees, etc.	145	17	0
To sale of *Transactions*	1	2	6
	£146	19	6

PAYMENTS. *Cr.*

	£	s.	d.
To Treasurer (repaid balance, June 1885)	6	17	9
Rent of Meeting Room, Attendant	9	9	0
Shorthand Writer	5	10	6
Whiting and Co. (Printers)	96	3	0
Shaw and Sons (Publishers)	5	9	11
Craven Printing Co.	1	13	0
Pulman (Stationer)	3	18	6
Pitman (Binder)	0	8	6
Lewis (Blackboard, Easel, etc.)	1	2	6
The Secretaries' Petty Cash	3	10	6
The Treasurer's ,, ,, ...	5	12	6
	£139	15	8
Balance in hands of Treasurer	7	3	10
	£146	19	6

Audited and found correct, June 7th, 1886.

A. WYNTER BLYTH.
C. E. SAUNDERS.

TRANSACTIONS OF THE SOCIETY,

1885-86.

TRANSACTIONS OF THE SOCIETY DURING THE SESSION 1885-86.

INAUGURAL ADDRESS

ON

THE HISTORY OF HOUSE SANITATION.

BY

W. H. CORFIELD, M.A., M.D.(OXON.), *President.*

Delivered October 16th, 1885.

In selecting a subject for my address to you, I have been chiefly influenced by the consideration that you would probably prefer that I should speak to you on matters with which I am practically familiar, rather than give you an address on some subject which I should have to get up for the occasion. In this I am only endeavouring to follow the excellent examples of your past presidents, and striving to maintain the eminently practical character of our Society. I need hardly point out to you that the subject which I have chosen, that of house sanitation, is one of the most important with which we, as Medical Officers of Health, have to deal, that it is one of growing importance; that the public are becoming every day more and more alive to the fact that the sanitary condition of houses is a matter of paramount importance to the health of the community; that the aid of other professions is being invoked in the matter; and that it is therefore necessary that Medical Officers of Health, the advisers of Local Sanitary Authorities in such matters, should keep themselves abreast of the subject, and keep their proper place as the pioneers of sanitary work. In these days, when men flock from the country to find work in our large cities and towns, the means to be adopted for the preservation of health and prolongation of life amongst those vast aggregations, press themselves upon our attention more and more urgently every day, and among these means no one of us can doubt that those which tend to the improvement of the sanitary condition of houses are among the most important. The

individual house is the unit of the town or city ; if it is in a good sanitary condition, other things being equal, the people will be healthy ; if not, they will, as you all know, be liable to a great variety of diseases, the health of the population will be at a low ebb, and the death-rate will be high. It is, therefore, with the individual house that we have to deal, for although houses differ from one another so much that one does not often find two alike in all particulars, however much they may appear to be so at first, the principles which guide us in laying down rules for the provision of sound sanitary arrangements do not vary ; the variations which exist, and which are neither few nor unimportant, being in the practical application of those principles to individual cases.

The title which I have chosen, looked at in its most comprehensive sense, includes the consideration of a great variety of subjects, the most important of which are the site, materials and method of construction, ventilation, warming, and lighting, prevention of dampness from the soil and removal of rain water, supply of water for domestic purposes, and removal of refuse matters, including the waste water, excretal matters, liquid and solid, other organic refuse, both vegetable and animal, and the miscellaneous refuse called dust ; but the adequate consideration of all these matters, in however brief a manner, would demand more time than is at my disposal on the present occasion, and I must therefore content myself by referring only to those which would generally be considered to come under the head of House Sanitation.

The removal of the surplus rain water, and the prevention thereby of dampness in the soil upon which houses are built, is a measure, the necessity for which has been recognised from very early times : thus, Livy tells us that because the waters did not drain away rapidly from the low-lying grounds about the forum of Rome and its neighbourhood, the Cloacæ, or great drains, were constructed to conduct such surplus water into the Tiber. These great drainage works were carried out under the direction of Tarquinius Priscus, the fifth King of Rome, 2,500 years ago ; and the work was done so well that it is in great part in working order at the present day, and the great outfall drain, the Cloaca Maxima, still fulfils its original function of draining the ground in some of the low-lying parts of Rome. From that day to this, the importance of drying the soil upon which houses stand, and the danger of living in damp houses, have been always recognised in a general sort of way, but it would ill become me, while speaking to you of this

subject, were I to omit to remind you that we owe to one of our most honoured members and past presidents (Dr. George Buchanan) the demonstration of the fact that the dampness of the soil upon which houses stand is one of the most potent causes of consumption, the great plague of our temperate climate. We have thus an additional incentive for insisting on the dryness of houses, and advising the construction of drains to carry off the surplus and lower the subsoil water, of impervious basement floors to prevent the passage of damp air into the houses, and of damp-proof courses in the walls to prevent the rising of water from the soil by capillary attraction in those porous structures. The drains having for their object the removal of water from the soil, have always been made, of necessity, pervious to water, so that the water may get into them, and they have also been made to discharge into the water-courses, the proper destination for the surplus water of the soil. Thus the Cloaca Maxima, the great pattern of all drains, was constructed of huge blocks of a volcanic rock, called Travertin, placed one upon another without any mortar or cement between them; and since the time of that splendid construction, drains have been made of stone or of bricks, with or without mortar, or of pervious tiles, and have been conducted, as it was, to discharge into the nearest water-course.

The disposal of excretal refuse matters has always been one of the most difficult and one of the most important problems to deal with in connection with house sanitation. The most usual solution of the question has been not to attempt the removal of such matters from the premises at all, but to dispose of them in pits dug in the soil and called cesspools, when nothing was mixed with the excretal matters, or middens, when ashes or other dry refuse were thrown in with the view of converting the contents into a more or less solid mass. The evils produced by this plan were: pollution of the soil under the houses, and consequent pollution of the air in and round them, and of the water when it was drawn from the same soil. In many towns we know it was the practice to dig cesspools down to a spring, that is to say, down to the level of the ground water, because when so constructed they never require to be emptied, the water continually removing their contents through the soil and into the adjoining wells, and thus affording what has been humorously called "the circular system of water-supply". There is no need that I should enlarge before you on the evils of such a state of things; I will merely mention the fact that great pestilences, such as the Oriental plague, or cholera, always rage in places where filth is

collected in and about the houses, and where the soil, the air, and the water are polluted ; and I believe that we have now but a small idea of the effects of such pestilences in ancient times. Great empires have been at different times in the world's history broken by war ; great cities have been ruined by it, and even utterly destroyed, like Carthage and Babylon, so that they have not risen again ; but the effects of war are as nothing to those of disease, as witness the example of a single outbreak of the plague—the black death of the middle of the fourteenth century—which is estimated to have killed forty millions of people in Europe, thirteen millions in China, and twenty-four millions in the rest of Asia and Africa. Famine, with its attendant diseases, has no doubt played a very important part in the world's history ; but there can be no doubt that filth-engendered plagues have played at least as important a one, and have contributed very largely, if not in many cases almost entirely, to the depopulation by death and desertion of many ancient cities, of which it may in some instances with truth be said that their site knows their name no more.

When it began to be found out that the accumulation of filth was the cause of disease and death, various attempts were made to ensure the more or less frequent removal of filth from the neighbourhood of houses. These methods consisted, in the first place, of making the receptacles impervious to water, so that they could not leak into the soil around, and therefore required to be emptied more frequently; and, in the second place, in making them smaller, which ensured the necessity of still more frequent removal of their contents. This process went on, until in some of our towns, where the plan is still in vogue, the midden is reduced to the space between the seat and floor of the closet, and the cesspool to a mere pail, tub, or pan under the seat.

These plans are, no doubt, a vast improvement on the old system of large pits under the houses, still in vogue in many Continental towns, but they are plans in which the refuse matters are kept in and about the premises longer than they need be, and in many instances until they become a considerable nuisance, and so they cannot be considered successful solutions of the problem of the removal of excretal refuse from houses.

The deodorisation of excretal matters, by mixing them in detail with dry earth, has been practised, at any rate as early as the time of Moses ; but we have seen it in our day developed into a system, believed by its advocates to be the best solution of the question we

are considering for small, and even for large, communities. The dry earth system, however suitable it may be for solitary houses with gardens, from which the earth is readily supplied, and upon which the compost can be used continually, or for large temporary collections of people, is, in my opinion, and for reasons which I have given in detail elsewhere, quite unsuitable to the wants of communities or of large permanent institutions, on account of the fact that it is not found practicable to carry it out efficiently under such circumstances, and in the case of large communities, also, on account of the enormous expense which would be incurred in the collection, drying, and distributing of the earth, and in the removal of the compost, which has been shown by chemical analysis not to be a manure, as was formerly supposed, but to be nothing more, even after use six times in the closet, than a rich garden soil, which will not bear the cost of carriage to any distance. The most important consideration, however, which must induce us to include this in a like condemnation with all the Conservancy systems is that with it, as with them, these refuse matters are kept on the premises longer than they need be, and in a certain number of instances, through one reason or another, must become a nuisance.

It must not be forgotten, either, that by the Conservancy methods refuse matters are only partly kept out of the drains, and so out of the rivers, for waste water of all kinds is, under such circumstances, discharged into the drains ; cesspools and middens are allowed to overflow into them, and, indeed, they are aptly described by the sentence applied by Livy to the Cloaca Maxima, which he calls "receptaculum omnium purgamentorum urbis", thus showing us that the inhabitants of ancient Rome soon found out what a convenient thing a great drain, with water running through it, was for the removal of excretal refuse. To such an extent does this conversion of drains into sewers take place that the Rivers Pollution Commissioners have shown us that the sewage of towns, where a Conservancy method is adopted for dealing with the excretal refuse, contains almost the same amount of impurity as the sewage of towns where all the excretal matters are discharged into the sewers, and is much fouler because it is staler.

The adventitious use of pervious drains for the discharge of foul matters thus became so general as to be practically universal ; but it is not generally known that the deliberate use of water for the removal of excretal matters by means of the drains is very ancient. Mr. Baldwin Latham, in his work on "Sewerage", says "the water-

closet is a very ancient device for receiving and carrying away in water fæcal matter. Its use has been traced to all nations that had arrived at a certain degree of refinement." They were probably of Asiatic origin, and originated in the custom, still universal in the East, of using water after defæcation. He tells us that they were introduced into Rome during the Republic, and that remains of them have been found in the Palace of the Cæsars at Rome and among the ruins of Pompeii, and gives a sketch of one found at the latter place, showing how the supply of water was directed along a gutter in front of the seats, and then through a urinal and along the channel under the seats into the sewer. It appears, also, that at the Palace of the Cæsars, "at the back of one still extant, there is a cistern, the water of which is distributed by cocks to different seats." From this, as may be expected, the use of water-closets in some simple form was more or less general in some parts of Europe before they were introduced into this country, which is said to have been in the reign of Queen Elizabeth ; although the plan of disposing of excretal refuse, by means of water, was in certain cases in use long before this, even in this country, as in the cases of houses on the banks of streams, or of castles surrounded with moats.

The earlier forms of water-closet were merely places provided with a seat and connected by a pipe with the drain, being supplied in some way or another with water; but there was no trap or other device for preventing foul air from the drains coming into the house, unless, indeed, a hinged valve, provided with a counterpoise, still in use in many towns on the Continent, is to be regarded in that light.

It is very interesting to examine the specifications for the water-closets that were first patented in this country.

The first on record is that invented by Alexander Cumming, and patented in 1775 : you will see by the sketch attached to the specification, of which I have here a copy, that the basin is bowl-shaped; that its outlet is at the bottom of it; that it has no overflow pipe ; that it has a sliding valve immediately under the outlet, and actuated by a series of levers connected with a handle ; that the water is supplied by a pipe apparently of ample dimensions, with a stool-valve on its course and a box for regulating the velocity of the water ; that the water is not admitted to the basin by turning the stool-valve, but by another valve on the course of the supply pipe, which is opened and shut by a lever connected with the handle of the closet, so that it is opened at the same time that the slider under the basin is drawn out by the raising of the handle, and closed

by the opposite movement. It will be noticed, also, that the water is delivered into the lower part of the basin instead of at the top, as is now the practice, and it will also be noticed that the soil-pipe is, as the patentee describes it, "recurved about 12 or 18 inches below the pan or basin, so as to constantly retain a quantity of water sufficient to cut off all communication of smell from below; and this stagnated water in the recurved part of the pipe is totally emptied and succeeded by fresh every time that the pan or basin is emptied." Several of the points in connection with this apparatus are very remarkable, especially the shape of the basin, to which, after trials of a great variety of shapes, we have returned as being the best; the existence of a valve on the course of the supply-pipe under the seat of the closet and actuated by the same movement as the sliding valve under the basin; and especially the use of the recurved soil-pipe, bent into the form of what we call the "S" trap, for the prevention of the access of foul air from the drain to the water-closet, and the fact that the great advantage of this form of trap, its self-cleansing character, is distinctly stated by the patentee: not only in the shape of the basin and in the use of the valve under the seat, but also in the use of this simple form of trap, have we returned to the plan advocated by Alexander Cumming. I should point out that it is not likely that the piece of pipe between the closet apparatus and the trap was comparatively as long as is shown in the drawing. I conceive that the trap has been shown lower down in order that it may not interfere with the rest of the sketch.

The second recorded patent for a water-closet in this country was taken out by Lemuel Prosser, in 1777. He merely describes it as "a water-closet upon an entirely new construction, which will always remain free from any offensive smell"; he gives no specification, and his sketches are of the most meagre description, and are almost incomprehensible, the only thing that we can gather from them being that the basin was intended to be bowl-shaped, and the water to be supplied by means of a small cistern attached to the basin and provided with a kind of double ball-valve. The apparatus could not be constructed from the sketches given, and I doubt if it was ever constructed at all.

We then come to the patent of the valve-closet taken out by Joseph Bramah, in 1778. This apparatus resembles Cumming's in the shape of the basin, and in the fact that the raising of the handle actuates both the valve under the basin and the apparatus for delivering water to it, but it differs in the fact that the valve, instead

of being a sliding one, is hinged, an obvious improvement, and one which has been adopted in all valve-closets ever since. It differs also in the fact that the water is not supplied through a valve under the seat of the closet, but from a service-box in the cistern over it, which service-box is provided with a valve somewhat similar to that under the basin of the closet, placed in such a manner that the service-box supplies an afterflush to the basin. For several reasons, which I need not point out to you, this is, however, not an improvement on Cumming's plan, but the reverse, and although still very generally adopted, but with a somewhat different valve, is a contrivance that we are trying to get rid of. It will be noticed, also, that Bramah's closet has an overflow pipe attached to the basin, provided with a bend forming a trap and discharging into the valve-box, which latter precisely resembles the valve-boxes attached to valve-closets of the present date. The advantages or disadvantages of an overflow pipe from the basin, when properly supplied with water, need not be discussed here, but it is quite clear that the overflow pipe, as shown in the drawing to this specification, with its trap almost certain to be unsealed each time that the closet was used, was the reverse of an improvement upon Cumming's basin without any overflow. The form of the trap to be used under the apparatus is not shown in this specification, but there can be little doubt that it was a recurved pipe or siphon-trap, which is not unfrequently found under old closets by this maker.

It is a remarkable fact that most of the essential points of a good valve-closet are to be found in one or other of these two patents of Cumming and Bramah. The invention by Underhay of the "Bellows" regulator, in 1853, rendered the valve-box in the cistern unnecessary, and allowed of the adoption of a valve under the seat by providing the necessary afterflush to charge the basin with water, and thus the connection of the basin of the closet with the water in the cistern was more securely cut off, and a number of minor advantages secured. On account, however, of the expensive character of Bramah's arrangement, an apparatus, both cheap and nasty, called the pan-closet, was devised, the radical evil of which is the large box, or container, underneath the basin, in which the pan is swung to and fro, and which, as you know, gets very foul. Although this apparatus cannot, from a sanitary point of view, be compared for a moment with Bramah's valve-closet, it became almost universally adopted, to the exclusion of the latter, and it is only now, and even now often with great difficulty, that we are getting rid of it. The recent

improvements in the valve-closet itself have consisted in the supply of water to it by means of a hollow rim round the basin, known as the flushing-rim, which ensures the cleansing of all parts of the basin ; the provision of a separate supply of water to the overflow pipe, or the abolition of this pipe altogether ; the fixing of the overflow pipe so that it opens into the valve-box behind the valve, and not, as in Bramah's design, opposite to the valve, in which position some of the contents of the basin are washed into the lower part of the overflow pipe and so make it foul ; and, lastly, the ventilation of the valve box by a pipe carried into the open air.

The "recurved pipe", which was intended to hold sufficient water to form a seal against foul air, was found frequently to be emptied, or at any rate unsealed, by the impetus of the water falling from the basin through it into the soil-pipe and forcing it to act as a siphon, whence its name of the siphon-trap. On account of the fact that this trap frequently became unsealed, a trap was devised which does not so readily lend itself to siphonic action. This trap was called, from its shape, the D-trap, but while remedying one defect, it introduced another, and a most serious one, in the fact that it was not self-cleansing, and was therefore a small cesspool under the seat of the closet ; nevertheless, just as the pan-closet ousted the valve-closet, a superior apparatus from a sanitary point of view, so the D-trap completely ousted the siphon, because it was not so liable as the latter to be unsealed by siphonic action ; and just as we are now replacing pan-closets by improved valve-closets, so are we getting rid of D-traps and replacing them by one or other form of siphon-trap, protected from siphonic action by adequate ventilation of the pipes connected with it.

A simpler form of water-closet has long been in use, especially in small houses, and in the basements of large ones : it is known as the hopper-closet, and consists of a long conical basin, or hopper, usually with a stoneware siphon-trap underneath it. The water, when there is any supply at all, is admitted to the basin through a hole in the side, in such a manner that it whirls round and round the basin and causes an eddy in the trap. Not only is the supply of water ludicrously inadequate, but the eddy produced in the trap prevents it from being self-cleansing ; moreover, the shape of the basin is such as to ensure its becoming filthy, especially as no water remains in it. This contrivance has been greatly improved of late years by the introduction of what are known as short hopper-basins, in which the back of the basin is nearly vertical, so that the fæces do

not fall directly on it, but into the trap ; and the water is introduced into the basin by means of a hollow, or flushing-rim, from which it descends on all sides straight down into the trap, forming a kind of plug of water, which forces out the contents of the trap. The method of supply has also been much improved by the use of flushing-cisterns, which assist greatly in the severance of direct connection between the cistern and the basin of the water-closet, a matter the importance of which is often overlooked. I quite recently came across a house in which the sanitary arrangements were supposed to be perfect, but in which the water supplying the tap of the pantry sink was drawn from a cistern, which not merely supplied a water-closet apparatus, but which was actually situated in the water-closet, and this in a hospital.

Various attempts have been made to construct simple water-closets without valves, and therefore less liable to get out of order, in such a manner that water should be held in the basin. The most obvious way of doing this is to deepen the trap by raising the outlet of it ; but this cannot be done without largely increasing the amount of water that has to be used. On account of this difficulty, basins have been invented with the outlet in some part of the side instead of at the bottom, the bottom of the basin being formed into a kind of shallow bowl holding water, and the contents being flushed out over the rim of this bowl into the outlet, and so into and through the trap. These wash-out basins are now largely used, but, according to my experience, they are not as cleanly as the improved hoppers.

A variety of other water-closet basins, with the outlet at the back, front, or side, are also much used ; but a similar remark applies to most of them, although there are special circumstances under which some of them may be used.

The vertical pipes, into which water-closets placed on floors above the ground discharge, and known as soil-pipes, have usually been made of stout lead, or of iron. These have, as a rule, been placed inside the houses, not only when the water-closets themselves were fixed, as they very often were, in the middle of the house, without any means of external ventilation, but also when they were against external walls, and when the pipes might have been, and quite easily, placed outside the house. Not only were these pipes very frequently imperfectly jointed, so as to allow foul air from the drains to escape into the house, but it was not considered necessary that they should be ventilated, and the result was, as Dr. Fergus, of Glasgow, shewed, by a series of experiments some years ago, that, especially in the case

of lead pipes, the foul air corroded them to such an extent as to perforate them in a multitude of places, forming holes by means of which the foul air escaped into the house. When the necessity for ventilating these pipes was thus established, it became the practice to attach a small pipe, say of 1-inch in diameter, or even in some cases of half an inch in diameter, to the top of the soil-pipe or to the top of the D-trap under the water-closet, and to carry that pipe out into the external air, and frequently up above the roof of the house; but the fact gradually became recognised that so small a pipe could only prevent the accumulation of the foul air under pressure, and that the soil-pipe and trap still remained full of foul air. These considerations led to the fixing of larger ventilating-pipes, and ultimately to the general rule that the ventilator of the soil-pipe should be of the same diameter as that pipe. We have now also come to recognise the fact that the soil-pipes should always be fixed outside of houses, where, in case of any defect, the consequence will not be so serious as if the pipe were inside the house. The use of water-closets in London began to be more general early in this century; for instance, in Mr. Cubitt's evidence before the Health of Towns Commission in 1844, he says: "I scarcely build any house, however small, without having a water-closet attached to it, and not a common privy. I believe the last twenty years I have not built any stable or coach-house, in which accommodation has been made for persons to live, without making a water-closet in the upper storey." But the water-closets, as a rule, discharged into cesspools, from the fact that the drains were not constructed for the reception of fæcal matter, and that the public authorities did not allow water-closets to be connected with the sewers if they could help it; nevertheless, in a vast number of instances, the water-closets were, of course, connected with the drains, or the cesspools were allowed to overflow into them, and thus the evils arising from the use of pervious drains for the conveyance of excremental matter, came to be recognised, and the use of impervious pipe-drains for this purpose to be advocated. Thus, Mr. Dyce Guthrie stated before the same Commissioners his opinion that circular pipe drains of not more than from 3 to 6 inches in diameter would be sufficient for any ordinary tenement, and would be cheaper and more effectual than brick drains; and in a letter he expresses himself still more strongly in favour of small pipes as opposed to large ones, when he says: "the sizes employed are from 9 to 18 inches, dimensions which I entirely disapprove of for the purpose of mere house-drainage."

It is interesting to notice that the use of large pipes for house drains was condemned almost as soon as the use of pipes at all for this purpose was advocated; but at the same time that these improvements in drainage arrangements were being carried out, clauses were put into Acts of Parliament to prevent water-closets being connected with sewers, and so to prevent the abolition of cesspools; for instance, in an Act relating to Liverpool, passed in the year 1844, a clause is inserted which "renders the owner of any house liable to a penalty of £10 for permitting offensive matter to flow from a privy or water-closet into any sewers under the jurisdiction of the Commissioners," and in fact the general policy which was pursued with regard to the drains of private houses was, as the Health of Towns Commissioners stated, "adapted rather to prevent than to encourage their general introduction", the communication with the sewer being "granted as a favour, not ceded as a right"; and they added: "We submit that it should rather be a matter of right for the owners of houses to carry such drains into the sewers, subject, of course, to the regulations laid down."

With the drains were also connected all the pipes that conveyed waste water from the house, besides the pipes from the water-closets; or the former were connected with the latter either directly or by means of the traps under the water-closets. These pipes are the waste or overflow-pipes of cisterns, the waste-pipes of sinks, baths, and lavatories, the waste-pipes of the safe trays under baths and water-closets, and the rain-water pipes. These were usually trapped in some way before being connected with the soil-pipe or drain; but this was by no means universally the case, even with the waste-pipes of the cisterns, which thus formed a direct connection between the drain and the interior of the cistern and of the house, with results well known to you all. The disconnection of the waste-pipe of the drinking-water cistern from the closet apparatus, soil-pipe, or drain, was thus found to be necessary, and this was followed by the disconnection of the other waste-pipes mentioned above; but for a long time it was not thought necessary to trap the latter, but only to cut them off from the drains and make them end in the open air. It was, however, found that waste-pipes so treated, especially if they were of considerable length, produced a nuisance, because the air which came through them into the house was rendered impure by passing through a dirty pipe; and so the necessity of trapping these waste-pipes has been recognised. The traps formerly used in connection with sinks were the bell-trap and the D-trap, both well known to you

as examples of bad sanitary appliances; but these are fast being replaced by the siphon-trap. In this connection I must point out to you that American sanitarians do not disconnect the traps of waste-pipes of sinks and baths from the soil-pipe; they connect these water-pipes with the soil-pipe, ventilating each of them by a pipe carried up through the roof just beyond the trap under the sink or bath, as the case may be, to prevent siphonage of the traps; this is on account of the severe frosts, which render the use of open gullies for this purpose impracticable. I need hardly say that I am of opinion that the plan of cutting off such waste-pipes, or the drains into which they discharge, altogether from direct connection with the soil-pipe or soil-drain should be adopted wherever practicable, as it always is in this country. With regard to the rain-water pipes, it is not sufficient merely to trap them at the foot and connect them with the soil-drain, as foul air gradually passes through the water in the trap and fills the pipe above it, from which it escapes at the top in the neighbourhood of bedroom windows. The practice, therefore, now is to disconnect the rain-water pipes from the soil-drain and make them discharge over the yards or areas, except, of course, in cases where the rain-water is collected, in which case the rain-water pipes are connected by special drains with the rain-water tank, the overflow from which should not discharge into the soil-drains.

But we have gone further than the disconnection of such waste-pipes from the soil-drains. It was formerly the practice to put a water-trap at the foot of the soil-pipe, and frequently another on the course of the drain before it joined the main sewer or cesspool; the trap used was known as the dipstone-trap or tongue-trap, or cesspool, as it is still called in Yorkshire, and it well merits the latter name, for it is certainly not a self-cleansing trap, and in many instances was made intentionally so deep as to act as a cesspool. These traps were constructed long after the introduction of pipe-drains, but they are now almost entirely replaced by the stoneware siphon, or U-trap, as it would be better called, which is, if it be not too large for the amount of water that has to go through it, a self-cleansing trap. The plan that I have sketched up to the present time, viz., that of trapping the drain before its junction with the sewer or cesspool, of trapping the soil-pipe and also the rain-water-pipes at their foot, and of ventilating the soil-pipe above the roof of the house, was practised for some years, and is now still practised in some places; but it was seen that the ventilated soil-pipe, while it

provided an outlet for foul air, still left the drain and soil-pipe full of foul air, and so the principle of disconnection was applied at first to the soil-pipe, and afterwards to the house-drain itself, by the provision of air inlets in connection with the traps. In some cases the soil-pipes are disconnected from the house-drain by means of traps with air inlets ; in other cases, and especially where the house-drain is a short one, the soil-pipes are connected directly with the drain, and the latter is disconnected from the main sewer or cesspool, by a trap with an air inlet, or still better, by a ventilating air-chamber or man-hole, as first suggested by Mr. Rogers Field. In this way the passage of fresh air through the drains is ensured, and the passage will always be in the right direction if the outlets at the top of the soil-pipes are above the ridge of the roof, and not sheltered by any higher buildings or by chimneys close to them. If they are, when the wind blows across the top of the pipe and against the higher buildings, air will be forced down the soil-pipe, and will escape at what should be the air inlet. The use of valves to prevent air coming out at the air-inlets is a confession of weakness, and leads one at once to suspect that the outlets are not placed in proper positions where they will be free from down-draughts ; so, too, the use of gas jets, to cause a current of air in a particular direction through the pipes, is, in my opinion, entirely unnecessary. But an entirely new practice has been developed in recent years; although it has been for some time past considered necessary to make pipes for the conveyance of foul water impervious to water, so that their contents may not escape into the soil around the houses ; in view of the fact that in large towns the drains must, in the majority of instances, be laid under the houses, it is only comparatively recently that it has been considered necessary to apply physical tests to prove the soundness of the drains and soil-pipes. Such tests consist in the filling of the drains and pipes connected with them with smoke, or with some strong-smelling substance, as oil of peppermint ; or, still better, in plugging them and filling them with water or with compressed air, to see if they are water-tight and air-tight. I regard the application of these tests as one of the most important advances in modern sanitation, and as likely to lead to many great improvements. It has already led to much greater perfection in the jointing of pipes, and to much greater care in the carrying out of sanitary arrangements generally. It has, however, also led to the use of iron pipes for drains instead of stoneware ones. It would take too long to discuss the relative merits of these two kinds of pipes ; a

great deal may be said on either side, but I will merely point out here that iron pipes, although coated with preservative materials, are perishable, whereas stoneware pipes, although they have some disadvantages, are made of an imperishable material. A vast improvement has been made in our methods of flushing drains and sewers by the invention of self-acting flushing-tanks, also due to Mr. Rogers Field. The cases in which their application is useful seem almost endless; but in connection with houses I will merely mention their great value in the solution of the difficult question of the disposal of greasy water from scullery sinks, as they not only serve to retain the grease and sand, and prevent them from clogging the drains, but afford a flushing power for the cleansing of these drains. I must also mention the fact that the principle of siphonic-action has been introduced in a great variety of forms into flushing-cisterns or water waste-preventers for the supply of water-closets and urinals, with the greatest possible advantage. The use of self-acting flushing-tanks in connection with irrigation, in one or other of its forms, is also gradually doing away with the use of cesspools, even for country mansions, and by this means the sewage is disposed of, without any nuisance, from day to day as it is produced.

Of all the great improvements in house sanitation during recent years, I should place the recognition of the principle of disconnection, that is to say, of the provision of an air-break in connection with a water-trap, as by far the most important.

Among legal decisions during the last few years, unquestionably the most important has been the decision of the late Mr. Justice Quain—afterwards upheld on appeal—that it was implied in an agreement for taking a furnished house for a short period that the house was fit to live in. It was proposed to make a similar provision for unfurnished houses, under a clause in the Housing of the Working Classes Act of last session, but in the end it was omitted, except as regards dwellings for the labouring classes, and, on the whole, I think wisely, for the taking of a house on lease, or the purchase of a house for a time, or altogether, is a very different thing from the taking of a furnished house for the season. A survey by a competent person is necessary, and this can perfectly well extend to the sanitary arrangements. The existence of such a clause in an Act of Parliament would also lead to an excessive amount of unnecessary and vexatious litigation. It has been even suggested that in future legislation particular sanitary arrangements shall be insisted upon, as, for instance, that it shall be compulsory to

have a disconnecting arrangement between the house-drain and the main sewer. Considering that all sanitarians are not agreed as to the advisability of such an arrangement, I think that the insertion of a clause in an Act, making it part of the law of the land, would be most objectionable. It has also been suggested that all houses should be certified by somebody, presumed to be competent, as to their sanitary condition. I should be inclined to support this suggestion if I had not good reason to fear that it would, in too many cases, lead to a false sense of security, and in the end do more harm then good. It would no doubt lead, for the time being, to a great amount of so-called sanitary inspection and surveying, and would give those who are engaged in these matters a great deal to do; but I doubt if much of the work done, or the way in which it would be done, would be in the end satisfactory. No one can be more anxious than I am that the recent great improvements in the sanitary arrangements of houses should be placed within the reach of all, and that all should benefit by them, but this result will be achieved far better by individual effort than by legislative compulsion, especially if the latter be accompanied with the stereotyping of particular arrangements. In these, as in many other matters, grandmotherly legislation should be avoided as much as legislation in a panic.

I have been obliged to leave out of consideration altogether the important question of the ventilation of rooms, and to touch only very lightly and indirectly on the question of water-supply, each of which subjects would easily furnish material for such an address; but I venture to hope, that in spite of these shortcomings, you will consider that I have sufficiently endeavoured to fulfil the promise implied in the title of my paper.

THE CHOLERA BACILLUS OF KOCH.

By G. A. HERON, M.D.

(*Read: Nov. 20th*, 1885.)

Some little time ago, the President of this Society asked me to read to you a paper, which should contain a *résumé* of what seemed to me to be the more important points in the bacteriology of Koch's recent work upon cholera. This subject has already been so fully and so ably discussed in almost all civilised countries, that I should not, of my own motion, have thought of bringing it under your notice now. As I have just said, this subject has been already very fully discussed ; but it is nothing less than astounding to find how few men in this country clearly apprehend the significance of the chief bacteriological observations made by Koch, in his inquiry concerning cholera. Not long ago—it was, I think, during August or September—I was surprised to read in *The Times*, that "no one in England, who is entitled to hold an opinion on the subject, believes in Koch's teaching with regard to the connection which he says he has discovered between the comma bacillus and cholera". I am not now making a verbally accurate quotation from *The Times*, because I speak entirely from my recollection of what I read in that paper. I am, however, giving the sense of what was there stated. Now, that statement is so contrary to what is the truth, that it is surprising to find it even in *The Times*, where we have lately been accustomed to read about people being cured of hydrophobia before thay have shown any symptom of the disease ; of the approaching extinction of charbon amongst sheep, owing to the protection given to the flocks by the "attenuated virus"; and so on and so forth.

My duty to the Society to-night, is to endeavour to lay before the members an accurate outline of the chief points in Koch's cholera work, and to do that within such limits as shall leave ample time for discussion. These being the conditions, you will, of course, understand why I must leave much that is of interest in our subject quite untouched.

As the result of his investigations of cholera cases, Koch stated

that he had found a certain organism in the dejecta of cholera patients ; and that, after death, the same organism was to be found, in all cases of cholera, in the contents of the small intestine, especially in the lower part of the ileum, where, in typical and acute cases, an almost pure cultivation of this organism was to be found growing in the contents of the gut. This same organism was also described by Koch as having been observed by him in the tissue of the intestine, and especially in the lower part of the ileum, in cases dead of cholera. This organism Koch described as resembling, when seen in the tissues, the bacillus of glanders. He kindly showed me sections containing, in separate specimens, these two organisms. The resemblance between them is very obvious, as was shown by those sections; for in the tissues the bacillus of glanders oftentimes has a slightly curved appearance,—although, of course, it is a straight organism, and only bends when it is subjected to pressure. Also, when seen in the tissues, the cholera bacillus loses, very often, its characteristic curve to a considerable extent. These two organisms, in that way, approach each to the type of the other when they are looked at in tissues ; though it is hardly necessary to say, that, growing elsewhere than in the tissues, the two organisms have practically no real resemblance to each other, excepting that they are about the same size. Koch thus describes the bacillus which he discovered in connection with cholera:—"As the tubercle bacilli are known to everyone, I will compare the cholera bacteria with them. The cholera bacilli are about one-half, or at most two-thirds, as long as tubercle bacilli, but much more bulky, thicker, and slightly curved. This curve is generally not more marked than that of a comma ; but sometimes it is larger, becoming semicircular. . . . . In other cases it is seen that the curve is doubled, that one comma is attached to another, but in an opposite direction, so that it forms the shape of S. I think that, in both cases, two individual commas, after being divided, have remained stuck together, and accordingly give the appearance of a more marked curve. But in the artificial cultivations, besides these, another very remarkable form of development of the comma bacillus is to be found, which is very characteristic of it. The comma bacilli frequently grow in threads of longer or shorter length ; but they do not then form straight threads, like other bacilli—for instance, anthrax bacilli, or simple wavy threads—but very tender, long spirals, which, as far as their length and the rest of their appearance are concerned, bear the closest resemblance to the spirochætæ of relapsing fever. I could not distinguish them one from another if I

had them side by side. Owing to this peculiar form of development, I am also inclined to the view that the comma bacillus is not a genuine bacillus, but that it is, properly speaking, a transition form between bacilli and spirilla. Perhaps, indeed, we have here to deal with a genuine spirillum, of which we have a fragment before us." That is Koch's description of the bacillus which he found, for the first time, in cholera cases. But as no man who is called Jones can by any possibility be distinguished by his patronymic alone from any other man who is also called Jones, so no curved bacillus can be properly distinguished from other organisms like to it in appearance, unless its special peculiarities are made so evident as to stamp its individuality in such a way as shall procure for the organism a special and sure recognition. It was not enough that an organism, and apparently always the same organism, should be found in cholera cases : it was necessary to prove to demonstration that the organism was always the same. The characteristics of the comma bacillus, as seen under the microscope, although they form part of the proof of the identity of the organism, are by no means to be taken as completing that proof. Before the identity of an organism is fixed, some of its physical and other characteristics must be ascertained by the microscope ; the organism must be made to grow in various media, and the conditions of its growth, or of its refusal to grow, must be observed ; and, lastly, its effect when introduced into living animals must be studied by means of numerous experiments. Having repeatedly seen a curved bacillus in the intestines and in their contents in cases of cholera, Koch had to settle, first of all, the important question of whether this comma bacillus was always present in cases of cholera. He found the organism present in every person dead of cholera whose body was given to him for examination. From that series of observations Koch felt himself entitled to say that a comma bacillus was always present in cholera. The next point to be settled was, whether it was always the same comma bacillus which was found in the dejecta, and in the intestines and their contents in choleraics. That could only be decided by finding what peculiarities marked the growth of this particular bacillus in various media. It was soon found that its growth in nutritive gelatine, of a certain composition, was perfectly distinctive, differentiating this particular comma bacillus from all other known organisms. The gelatine is prepared by allowing 250 gram. of lean beef to soak, during twenty to twenty-four hours, in gram. 500 of water, placed in a vessel in a cellar, so that it may be kept at a low temperature.

Four hundred c. c. of the fluid resulting from this soaking are then filtered through a towel. One per cent. of peptone, one-half per cent. of common salt, and ten per cent. of ordinary gelatine, are next added to the filtrate derived from the beef mixture. The whole is then heated, and the ingredients are dissolved and thoroughly mixed together. The mixture is then neutralised with carbonate of soda, boiled for one hour, to ensure the precipitation of all its albumen, then filtered, and poured into sterilised tubes; and, lastly, the tubes containing the gelatine are, with their contents, made to undergo a final and thorough sterilisation.

Now, if a piece of platinum wire be thoroughly disinfected by heating it in a gas flame, and, when cool, charged with the comma bacilli which Koch found in choleraics, and pushed into the gelatine contained in one of these test tubes, it will be found that a growth will appear which is, especially during the first few days of its life, characteristic of the comma bacillus of cholera. Koch describes it in this way:—"As soon as the cultivation begins to develop, you see a little funnel, which marks the point where the inoculation took place. By degrees, the gelatine liquefies in the neighbourhood of this point of inoculation ; then the little colony is plainly seen extending itself more and more ; but a deep spot, sunken in, always remains, which looks, in the partially liquefied gelatine, as if an air-bubble were hovering over the colony of bacilli. It almost gives the impression as if the bacilli vegetation not only caused a liquefaction of the gelatine, but also a speedy evaporation of the liquid formed. We already know a number of other kinds of bacteria which in quite the same manner gradually liquefy the gelatine in test tubes, starting from the point of inoculation. But in these cases there is never such a cavity, nor this bubble-like hollow space.

"When the comma bacillus is sown in meat gelatine spread upon glass plates, it grows in little colonies, which assume a form hitherto unnoticed in connection with the growth in gelatine of any other bacterium. When it is very young, the colony looks like a very pale and tiny drop, which is, however, not quite circular, that being the usual form assumed by colonies of other bacteria in gelatine. It has a more or less irregularly bordered, hollowed out, and sometimes rough or jagged outline. It also has, at a very early stage, rather a granulated appearance, and is not of such regular form as other colonies of bacteria. When the colony becomes somewhat larger, this granulation becomes more and more evident ; at last it looks like a little heap of strongly refracting granules. I might best com-

pare the appearance of such a colony with the appearance of a little pile of finely broken glass. As they grow, the gelatine liquefies in their immediate neighbourhood, and the colony sinks down at the same time deeper into the mass of gelatine. A funnel-shaped cavity is thus formed in the gelatine, in the midst of which the colony is seen as a little whitish point." That is Koch's description of the growth of colonies of the cholera bacillus on gelatine spread upon plates.

The comma bacilli are also found to have a peculiar law of growth when they are cultivated upon potatoes, properly prepared. At ordinary temperatures these bacilli do not grow, or rather, their growth upon potatoes is hardly perceptible.

Now, before it can be fairly argued that Koch has failed to establish his claim for the recognition of this comma bacillus, another curved bacillus must be shown which grows in gelatine, of the composition mentioned above, and on potatoes, in precisely the same way, and under precisely the same conditions as Koch's comma bacillus grows. Till that has been done, no man, who understands even a little about the value of facts in bacteriology, will say that Koch's work, as regards the specificity of the comma bacillus found in cholera, has been materially affected. This question, like most other questions in bacteriology, can be settled only by experiment, and the production of specimens. Few subjects within the realm of science have caused more wars of words than has bacteriology ; and yet one of its chiefest charms is, that its facts are capable of being demonstrated in such a way, that much speaking about whether its facts are facts or myths, seems absolutely needless. Such, however, is the ingenuity of man, that upon this very question of whether Koch has, or has not, established the specific identity of the comma bacillus of cholera, a deluge of words, written and spoken, has flooded medical debates and medical literature. The curious, I had almost said the funny, part of it all is, that in not one single instance has an opponent of Koch's teaching brought forward specimens, showing that an organism has been discovered which, under the microscope, is undistinguishable from Koch's comma bacillus : which grows in gelatine on plates and in tubes as Koch's comma bacillus grows, and which behaves when sown on potatoes as Koch's comma bacillus behaves. We have been shown curved bacilli under the microscope, and told that they had been taken from the mouth of a healthy child, and that, therefore, Koch's researches on cholera were ridiculous. But, when we tried to grow these curved bacilli of the

mouth, in gelatine of the composition I have mentioned to you, we found that they would not grow in it. Again, we were shown curved bacilli which had been found in fæces fourteen days old, and we were asked to regard this organism as identical with Koch's. We found, however, that this bacillus grew rapidly on potatoes at ordinary temperatures, and that its growth in gelatine was as easily to be distinguished from that of Koch's comma bacillus as is a growth of red hair from one of black hair.

Dencke discovered a curved bacillus in old cheese. He examined it under the microscope, and he cultivated it in various media ; and so, applying to this organism the proper tests, he soon found that though it was a comma bacillus, and, therefore, not unlike to Koch's bacillus of cholera, yet it could not possibly be identical with it, because its mode of growth, in various media, was markedly different from that of Koch's bacillus. The same remark applies to a curved bacillus which Miller has found in a hollow tooth.

Here I wish to impress upon the Society how carefully every step of Koch's work has been verified. I spent my holiday last year in working in the laboratory of the Health Office in Berlin. While there, I, at Koch's suggestion, joined a class consisting of Medical Officers of Health, and others, who were receiving, under Koch's supervision, a thorough training in the method of detecting the comma bacillus of cholera, and other similar organisms in fæces, and elsewhere. In order to do this, the threefold test, which I have tried to describe to you, was put into constant practice ; that is to say, we examined the organisms under the microscope, we grew them in gelatine, and we sowed them on cooked potatoes. There were fourteen men, including myself, in the class which Koch kindly allowed me to join. Our work was constantly and most carefully supervised by Koch himself, and by Gaffky. We were divided into sub-classes, and in the one in which I was there were four workers. Each sub-class was supervised by one of Koch's highly trained assistants, who, so far as my experience went, was, practically, never absent from the sub-class of which he was in charge. For ten days, from 9 A.M. till 4 P.M., and not unfrequently an hour or so beyond that time, we were, with the exception of half an hour, about noon, when we lunched, constantly occupied in going over the experiments I have been speaking to you about. By the way, I should have said that on Sunday we were only expected to work till about two o'clock in the day ; for, as a fellow worker explained to me, "One must give a little time to paying social visits, and so Sunday afternoon comes

in usefully." Now, something like 150 men have passed through this special course of instruction ; and amongst them were several persons whose names are well known in the records of scientific research. After I had gone through the course, and while I was still working in the laboratory, I saw the occupants of two professorial chairs, in different Universities, working in one of these classes of special instruction, and following the course which I had passed through. Now, my reason for dwelling, at what may seem to you unnecessary length, upon this point, is to show you that Koch's experiments have been gone over again and again by men, most of whom were certainly able to detect any source of error in the experiments ; and some of whom were well acquainted with bacteriological methods of investigation, before they began to study Koch's cholera work under Koch's own supervision. So far as I know, not only have these 150 men uttered no word of dissent from the truth of Koch's teaching, but certain of them who entered upon the course of training with, I have heard, both distrust and prejudice, ended by becoming convinced of the truth of what they saw with their own eyes, and handled with their own hands. And in this connection I wish to say, that when a man, no matter how high placed in bacteriological science he may be, no matter how brilliant his past achievements in that line of research may be, be the man even a Koch or a Pasteur, yet, when even such a man shows something new to us in bacterial life, before his statements can be accepted as probably free from error, his work must be submitted to experimentation by others, and some reasonable amount of endorsement of the truth of the discoverer's new teaching must be forthcoming. Koch's work has been submitted to experimentation, and many men, perfectly competent to hold and to express an opinion concerning it, have convinced themselves of the truth of the work.

Comparatively few men, working on Koch's lines, have, in Europe, had a sufficiently extended experience of cholera, during the epidemic of that disease which is still smouldering in southern Europe, to entitle them to speak with authority concerning the value of that work. A sufficient number have, however, spoken and written about their convictions after personal study of the subject amongst persons suffering from cholera. Amongst those who, in this way, have arrived at the conclusion that Koch's cholera bacillus is always present in cholera, and that it has never been found elsewhere than in cholera, and that it is readily and certainly distinguishable from all other known organisms by well-known tests,—amongst these men

are, Van Ermengem, Nicati, and Rietsch, in Marseilles ; Babes and Pfeiffer, in Paris ; Ceci, Escherich, Armanni, and Fede, in Italy ; and Schottelius, in Turin. Amongst these names are those of men who must, in a question of this sort, be received as entitled to speak with high authority. The man, or the men, who assert that Koch's work is not sound, and is all a delusion, must show specimens which prove that another organism has been found which is indistinguishable from Koch's comma bacillus, when it is submitted to the threefold test which I have mentioned to you. And even that would not be sufficient, unless the work, which went to prove Koch's results wrong, were taken in hand by other competent persons and approved by them.

Before going further, I wish to draw your attention to the precise significance of that portion of Koch's cholera work which I have now laid before you. In it is contained the whole proof of Koch's assertion, that the comma bacillus, which he discovered, is always found in cholera, and that it is an organism easily distinguishable from all other known organisms. Also, pray observe, that we have not yet seen an organism which responds to the threefold test, which I have mentioned, in the way in which the comma bacillus of cholera responds to it : in other words, this comma bacillus is peculiar to cholera, never having been found in association with any other diseased condition of body, nor in health. Moreover, if you admit the truth of these positions, you must, it seems to me, recognise in Koch's comma bacillus a sign by which a case of cholera can, and ought to be, recognised with absolute certainty. I will, if you please, repeat in substance here what I have said elsewhere on this point. In 1866, during the time that cholera was epidemic in France, I saw a good deal of the disease in Paris. At first, I saw isolated cases of, what seemed to me to be, examples of severe attacks of diarrhœa with vomiting. It was an open secret that cholera had occurred in Paris at that time. It was not, however, until these occasional instances of persons being brought into hospital, suffering from diarrhœa and vomiting, had become almost a daily feature of the hospital service, that they were definitively pronounced to be cases of cholera. Now, had Koch's work been then before the medical men of Paris, an examination of the dejecta of the first case suggestive in its symptoms of severe bowel disorder, would have led to the discovery of Koch's comma bacilli, and the consequent recognition of cholera as the cause of the patient's illness. The result of that would have been—or rather, I should have said, the result ought to have

been—that the first cases of cholera would have been surrounded with all those precautions which we have every reason to hope and to believe will, provided they be taken in time, prevent the spread of the disease, or, at least, limit it. I have, since that time, spoken to many men who have had large experience of cholera in India and elsewhere, and I have never been able to get from one of them any indication by which I should be able to recognise, with certainty, a sporadic case of cholera. From my own experience of the disease during 1866, I must say that I am still more than doubtful whether I could, without the help of Koch's discovery, distinguish between a sporadic case of cholera and a severe case of diarrhœa with vomiting. To a Society of Medical Officers of Health I need not pause to point out that it is from the sporadic cases that we have most to dread.

About ten months ago, I submitted, at different times, the evidence which I have given you, to two men of considerable eminence, one of them a physician, and the other a man whose life has been given up to scientific pursuits. Both of these men listened, with close attention, to what I had to say ; and both asked, almost in the same words, the same question, "Why", they said, "does not Koch perform experiments on animals, and in that way put his comma bacillus to the one test by which it must be either proved to be, or not to be, the cause of cholera?" Now, everyone will at once admit, that, when possible, it is a good and a desirable thing to conclude the proof of the *rôle* which an organism plays in the history of a disease, by introducing the organism into the body of a healthy animal, and observing the result. The cases, however, are by no means few where such a result cannot be obtained ; because we cannot infect animals, so far as our present knowledge goes, with all the parasitic diseases to which mankind are subject. It is obvious, therefore, that it must occur, now and again, that diseases to which man is prone, and which are known to be associated with the constant presence of an organism, must be judged of, as regards their relationship to that organism, from a point of view which does not include the results of experiments on animals. We have an excellent example of this in the bacteriological history of relapsing fever. There we have an organism, a spirillum, which is always found in the blood of persons suffering from that disease, during its febrile stages. When this spirillum was first discovered, it was not found to produce relapsing fever in animals ; but its constant association with that disease in man seemed, to many who were entitled to express an opinion upon the subject, to be, in itself, proof of the

causal relationship which the microparasite was believed to bear to the disease. Now, it is twelve years since Obermeyer made known his discovery of the spirillum of relapsing fever. Since that time, Vandyke Carter has succeeded in inoculating monkeys with relapsing fever—using human blood, containing the spirillum of Obermeyer, as his medium ; and the blood of the infected monkey was found to contain large numbers of the parasite. It was in 1879 that V. Carter published the account of his successful inoculation of monkeys, and so completed Obermeyer's work. When Obermeyer made his discovery of the spirillum in 1873, it was urged that one could not feel sure whether the spirillum was not the result of the peculiar action set up in the blood by the relapsing fever, instead of being the cause of that disease. It was asked, "How are we to know that the seeds of this spirillum may not have been wandering about in the blood, at the very time that the fever seized upon the patient, and gave to the blood some peculiar property which enabled it to give the impetus of rapid growth to those seeds?" In 1873 that question was justified by the fact that bacteriological science was then uninformed on many points which are to-day common knowledge. To-day, we can point to a considerable number of infectious diseases which are proved to be caused by organisms. When, to-day, it is suggested that an organism, which is always found in considerable numbers in the solid tissues, or in the blood, or in the secretions in any one diseased condition, and is not found elsewhere, is not the cause, but the consequence, of that diseased condition—when, I say, that position is taken up to-day, the bacteriologist can point to the long series of diseases which have been proved to be due to specific organisms, and is entitled to ask, "Why is it that in the whole realm of bacteriology nothing has yet been discovered that, in the slightest degree, justifies the position which you assume?" The bacteriologist has now the right to reason from what he is entitled, by the records of his science, to accept as facts ; and, amongst other things, he is justified in declining to accept as true a supposition like the one I have referred to, and which is absolutely unsupported by anything that is known of the relationship which organisms bear to disease. Find an organism always associated with a disease, and never found under any other condition of body, and a large number of bacteriologists will believe that you have found the cause of the disease. I do not know in how far that position is to-day approved by the medical profession ; but I venture, gentlemen, to ask you to allow me to trespass upon the domain of prophecy,

and to say that, before many years shall have passed away, the view of the few to-day will, in this matter, have become the belief of the many.

Having thus prefaced what I have to tell you about Koch's experiments upon animals with the cholera bacillus, I will briefly lay the results of that part of his research before you. I propose to refer only to Koch's later experiments, which he recently described in detail at the second meeting of the Cholera Conference in Berlin.

Before beginning his last series of experiments, Koch turned his attention to a study of the process of digestion in the guinea-pig. He selected that animal, because he had found it to be particularly susceptible to the influence of the cholera bacillus.

Koch's first observation in this connection was, that the stomach of the guinea-pig is always completely filled with a mass of food. He goes on to say: "I supposed, to start with, that if a large quantity of fluid containing comma bacilli were suddenly injected into the stomach, this fluid would be able to force its way through; but I very soon convinced myself that this was quite impossible. One could sooner burst the stomach than force aside its thick, solid mass of contents. The smaller gut is, on the contrary, in guinea-pigs almost empty. The contents of the stomach have a strong acid reaction, whereas the slimy contents of the small gut are alkaline; but the contents of the cæcum, which in these animals is very large, have a distinctly acid reaction, so that only in the small gut is there an opportunity offered for the growth and increase of the comma bacillus." (This statement refers to the fact, which Koch had previously ascertained, that the cholera bacillus is killed by the acidity of the contents of the guinea-pig's stomach.)

Various experiments were then made, the outcome of which was to show that the food passes slowly through the stomach of the guinea-pig, very quickly through the small intestine, and remains a long time in a state of acidity in the cæcum. It being a fact that a slight degree of acidity will temporarily suspend the virulence of the comma bacillus, and that a stronger degree of acidity will kill the organism, Koch decided to attempt to counteract the acid reaction of e stomach, and so allow time for the comma bacilli to pass through that organ unhurt. This was accomplished by giving the animal 5 c. cm. of a 5 per cent. solution of carbonate of soda,—a dose which the guinea-pig took without any sign of discomfort. For three hours from the time that the carbonate was introduced, the contents of the stomach remained alkaline. As soon as that fact had been

established, Koch fed animals with cultivation of the cholera bacillus, and, in certain instances, injected the organism directly into the stomach.

Of the first nineteen guinea-pigs experimented on under the conditions just mentioned, only one became ill and died ; although, in the cases of the other eighteen animals, which were killed twenty hours after the administration of the comma bacillus, that bacterium was found in the small intestine. In that way it was evident that the cholera bacilli had passed uninjured through the stomach, without producing any deleterious effect. The guinea-pig which died had aborted just before the infection, and this suggested to Koch, that either the act of abortion, or its unknown cause, had, in some way, so affected the organs of the abdomen, and particularly the small intestine, that a temporary paralysis of peristaltic action had been induced, and so a longer time was given to the comma bacilli for their passage through the small intestine. In that way, it seemed probable that these bacteria had leisure given them in which to form their nest, and increase in numbers in the alkaline ileum. In order to imitate, as well as he could, these conditions, Koch, after various experiments, selected opium as the drug best suited for his purpose. Accordingly, 1 c. cm. of tincture of opium was given to every 200 gram. weight of the guinea-pig. Such a dose may surprise those who do not know how remarkable is the tolerance of the guinea-pig for opium. As a matter of fact, these large doses of the tincture were followed by narcosis of high degree, lasting from half an hour to one hour. After that time, the guinea-pig showed no signs of uneasiness, and ran about and ate and slept just as usual. When, however, the cholera bacillus was introduced, the result was very different. The plan adopted was as follows :—Thirty-five guinea-pigs received a dose of 5 c. cm. of a 5 per cent. solution of carbonate of soda ; then 10 c. cm. of broth, in which cholera bacteria were growing ; and, lastly, an injection of tincture of opium, in the proportion of 1 c. cm. of the tincture to every 200 grammes weight of the animal. Out of thirty-five animals treated in this way, thirty died with the following symptoms :—Failure of appetite on first day; paresis of the hind legs, the animal lying with its legs stretched out ; respirations weak and slow ; head and extremities cold to the touch ; cardiac pulsation barely perceptible, and death — all following on the second day after the experiment ; death ensuing two hours after paresis of the hind legs had shown itself.

Immediately after death the *post-mortem* showed the most decided

choleraic symptoms in the intestinal canal. The small gut was very red, and sodden with a watery, flocculent, colourless fluid, which filled the ileum. Also, the stomach and cæcum did not contain, as usual, a solid mass of food, but a large quantity of fluid. Diarrhœa had not taken place, but, on the contrary, there were still solid lumps of excreta in the rectum. When examined by means of the gelatine method, already described, the contents of the small intestine showed a pure cultivation of numerous comma bacilli.

These symptoms, and the *post-mortem* appearances, were identical with those seen in the case of the guinea-pig which had aborted, previous to receiving the injection of comma bacilli ; but in her case, it is right to remark, that no tincture of opium had been administered.

Eighty-five guinea-pigs have been treated in this way, and have died with the same symptoms, and with the same *post-mortem* appearances. The comma bacilli found in the intestine of these guinea-pigs were, in several instances, injected into other animals, which died under exactly the same conditions with those from which the organisms had been taken.

Control experiments were conducted at the same time with those just described. Tincture of opium, broth, and carbonate of soda were given to guinea-pigs, in the way I have just detailed, but no death nor illness followed, excepting narcosis, lasting for from thirty minutes to one hour.

Specimens were shown by Dr. Heron, illustrating the mode of growth of the cholera bacillus in gelatine and on potatoes, and its appearance under the microscope. He also showed, as a contrast to these, specimens of the Finkler-Prior bacillus, which, like the cholera bacillus, is a curved organism growing in the same media (gelatine and potatoes) with the cholera organism. The resemblance to one another of the two comma bacilli, when seen under the microscope, and the total dissimilarity of their respective growths in gelatine and on potatoes, were in that way demonstrated to the meeting. Dr. Heron remarked, that the specimens of the comma bacillus of cholera shown by him had been taken from a tube containing agar-agar, in which the organism had been growing for two hundred and forty-three days. Hitherto, the longest time during which the cholera bacillus had been known to live in any artificial medium had been one hundred and seventy-seven days.

With a non-parasitic life now shown to extend to 243 days, it was

not a matter for surprise that the cholera bacillus should, taking it for granted that it is the cause of cholera, induce outbreaks of disease at intervals of months from one another. Also, with so long a life outside of the body as 243 days, it was easy to understand how cholera could be carried from one end of the earth to another, if we were prepared to accept Koch's teaching with regard to the causal relationship which he believes to exist between the cholera bacillus and cholera.

Discussion.

Mr. Moore, in opening the discussion, remarked that there was nothing new or improbable in the assertion that organisms which appeared identical under the microscope might be shown by cultivation to be specifically distinct, since such was already known to be the case with many micrococci.

Professor E. R. Lankester considered the question still an open one, and denied that it had yet been shown that these bacilli were found in no other disease, or were the cause of cholera. He maintained that Koch was a pathologist, not a bacteriologist; that his work in this department was quite recent, and that he was commonly credited with much,—as, for instance, the "pure culture" in gelatine —to the discovery of which he had no claim. It was not to pathologists, but to the German botanist Kropf, Breffel, De Bary, and others, that we owed nearly all our knowledge of bacteriology; and they had long been aware that spirilla broke up into commas. Koch, he said, had found the position he took up two years ago quite untenable, and had shifted it. Thus, when in Egypt, the bacillus was straight, on which account he called it a bacillus; in the first report from India it was slightly curved, and in the later ones was a comma. Then Koch was not at first aware of any other commas in the human body, though Dr. T. Lewis had already discovered one in his child's mouth. Prof. Lankester questioned whether growth were a sufficient proof of difference, for plants assumed very different appearances under differing circumstances. Even supposing it to be peculiar to cholera, it did not follow that it was the cause. He also suggested that the doses of carbonate of soda given to the guinea-pigs might have produced the choleraic symptoms.

Mr. Wynter Blyth entirely agreed with Dr. Heron, and insisted on the practical importance of the bacillus as diagnostic, if not causative, of cholera. An epidemic of cholera generally began with, and

effected a footing through, mild non-fatal cases which were hitherto indistinguishable by any feature or sign from others of mere summer diarrhœa. It would thus be of incalculable service to Medical Officers of Health. Of this he had no doubt, though he found it hard to understand how so perishable an organism, killed by the weakest acids, and which had not yet been observed in any more resistent form as spores, could be productive of such results. Another difficulty he felt was, that a bacillus in the blood had been described by Emmerich, the injection of which into the blood produced symptoms like cholera.

Dr. C. E. SAUNDERS, recalling to recollection the experiments of Burdon Sanderson on the infection of mice with cholera, by the evacuations of cholera patients, desired to ask Dr. Heron if the excreta of cholera patients, irrespective of their being known to contain Koch's organism, had, during the last epidemic, been given to mice; and if so, whether Koch's bacillus had been found in the mice after their death.

Dr. CORFIELD could not forbear contrasting the state of things in Germany, where every Medical Officer of Health could be—if indeed he were not, as he believed—compelled to study in such a laboratory as that at Berlin, with what still obtained in this country. So far as he knew, there was not a single public laboratory in London or the Universities, a want which he felt to be a national disgrace. Summing up the previous discussion, he thought that all were agreed that the several forms of bacillus were distinguished by their growth, though identical to the eye, and that any arguments founded on the form of the bacilli themselves were beside the mark. In this respect the report of the Indian Government was most unsatisfactory. The question was whether Klein's assertions as to the absence of this particular bacillus in some undoubted cases of cholera, and its presence in cases other than cholera, were correct or not. Whether it were the cause of cholera, was to Medical Officers of Health of no importance. What did concern them was whether it were evidence of cholera.

Dr. HERON, in reply, criticised the composition of the Commission, which included no bacteriologist except Dr. T. Lewis and also Dr. Burdon Sanderson. If the references to "tubercular diarrhœa" and to "cholera nostras" had any meaning, they meant that the commissioners threw doubts on Koch's statement. Dr. Heron would accept no man's evidence without ample and independent confirmation by others. Dr. Koch's were so confirmed, and he demanded the like

confirmation of Dr. Klein's; but as yet it was not forthcoming. He had not alluded to Emmerich's statements, because they had not been publicly confirmed. Emmerich at first said that he had found his bacillus in tissues, but had since withdrawn the statement. As to the vitality of the cholera bacillus, it was, perhaps, not so feeble as was thought by some. He had kept it in a jar for five months, and some of the cultivations on the table had been made from a tube that had lain by for 243 days. In reply to Dr. Saunders, he stated that such experiments had been made, with the result that Koch's bacillus was found in the intestines of the mice operated upon. In conclusion, he maintained that Koch's bacillus was marked by characters quite unmistakable and distinct from those of every other organism, and his opponents must, if they could, show that it was not.

THE RECOMMENDATIONS OF THE ROYAL COMMISSION ON THE HOUSING OF THE WORKING CLASSES AS AFFECTING THE STATUS OF THE MEDICAL OFFICER OF HEALTH.

By EDWARD SEATON, M.D.

(*Read: December 18th*, 1885.)

Gentlemen,—I shall not occupy your time with any remarks upon the constitution of the "Royal Commission" which was appointed to inquire into a subject in which we are all of necessity deeply interested; a subject which, in one shape or another, has always demanded the almost daily consideration of large numbers of the medical profession. I concern myself, at present, only with the recommendations of the Commissioners which affect our own status as Medical Officers of Health, and which, I firmly believe, are calculated to produce a result the reverse of that which the Commissioners and all who are interested in the improvement of public health administration would desire. The recommendations are:—

1. That Medical Officers of Health should, in future appointments, be required by Sanitary Authorities to give their whole time to their official duties.

2. That they should be required to reside within a mile of the districts which they serve.

The object of my paper is to show that in the *present* state of public opinion, and with areas of Local Government as at *present* constituted, such restrictions as those recommended are calculated to retard, rather than to advance, the progress of that cause which we all have at heart, viz., the extension and application of medical and scientific knowledge for the benefit of the public health.

The question of the status of the Medical Officer of Health—that is to say, the character of his duties, his relation to his fellow officers, his emoluments, tenure of office, and his relation to the Local Government Board—is obviously a most important question in relation to the public health. It is hardly necessary to insist on this, because it is to Medical Officers of Health that the public

chiefly looks for the initiation of measures of sanitary improvement, and it is these officers who are charged with the important duties of advising and assisting Sanitary Authorities in all departments of public health administration. It is, therefore, clearly of public importance that the appointments of officials entrusted with such duties as we are expected to perform should be of a less unsatisfactory character, as otherwise it is certain that at no distant period it will be difficult or impossible to obtain the services of competent men in the medical profession for the posts. Some of you may remember that four years ago I came to a meeting of this Society for the express purpose of bringing before your notice an advertisement which had appeared in the newspapers for a Medical Officer of Health for one of the northern towns, in which it was set out, as his chief duty, that he would be expected to undertake the personal superintendence of the removal of the solid refuse of the town: that is to say, that he should be immediately responsible to the Authority for the control and care of the machinery—the men, the horses, and the carts—for this purpose. If my remarks failed to attract your notice at that time, I feel that now, with the experience of the last few years fresh in your memories, they will be sure to receive the attention which I believe they deserve. For so unsatisfactory is the position of a Medical Officer of Health who is required to devote his whole time to the public service, and who is consequently shut out from all other avenues of advancement, that the experienced Medical Officer for Newcastle-on-Tyne has brought the subject specially before the Society, in a paper which appears in the *Transactions* of last year ; and recently the same question has been referred to in a public manner in the very admirable and comprehensive address on Local Government Reform by Mr. Ernest Hart, the Chairman of the Parliamentary Bills Committee of the British Medical Association and the National Health Society, at the Leicester Sanitary Congress.

During the thirteen years that I have worked in the public service as a Medical Officer of Health, I have always had my doubts of the wisdom of that policy which has led some earnest sanitarians so strenuously to advocate as a general principle that which, for the sake of brevity, I will speak of as "whole service". My experience has led me to the conclusion that, while in exceptional instances (such as very large combined areas, and perhaps cities of the first magnitude) "whole service" might, with certain stipulations, be desirable in the public interests, under the ordinary conditions of

local government (in which small unions, boroughs, local districts, and parishes are separate areas), it is not desirable. It will, therefore, be appropriate if I commence with a reference to the opinions and arguments of some of the chief of those who have spoken or written on the subject.

Dr. Gairdner, the Professor of Clinical Medicine, and the late Medical Officer of Health for the city of Glasgow, has in his writings and speeches so clearly and forcibly stated the case against the entire separation of preventive and curative medicine, that it would probably be sufficient to refer to the well-known arguments of this eminent physician and Medical Officer of Health. Dr. Gairdner's views are those given in his letter to the *Lancet* of December 28th, 1872, every word of which deserves careful study by Medical Officers of Health at the present critical time. With regard to the views then expressed by him, Dr. Gairdner, in a letter which I received from him a few days ago, says, "On reading it" (the letter of 1872) "over, I am more than satisfied with my own arguments after fifteen years' interval." But I am desirous of adding expressions of opinion which derive weight, not only from the official standing of those who gave them, but also from the very high position they hold in our profession. These opinions are contained in letters (for public use) addressed to me when I was a candidate for the post of Honorary Physician to the Nottingham and Notts General Hospital, in 1873—that is to say, twelve years ago.

Mr. John Simon, C.B., F.R.S., at that time Medical Officer to the Privy Council and Local Government Board, and also President of the Royal College of Surgeons, Surgeon to St. Thomas's Hospital, etc., wrote as follows:—"Preventive medicine, as practised by the Officer of Health, has, no doubt, some studies which are special to itself; but in most of its extent it rests, or ought to rest, on one basis with our ordinary curative medicine; and there would accrue, I think, very serious disadvantages to its progress if that truth were not practically recognised by making the two lines of work as generally compatible as they can be."

Dr. Buchanan, F.R.S., the present Medical Officer to the Local Government Board, wrote as follows:—"I am desirous of using this occasion to state my conviction, that it is greatly to the advantage of the community that a Medical Officer of Health should have opportunities of hospital practice; and that a physician to a hospital has unusual opportunities of usefulness when he also holds the ap-

pointment of Medical Officer of Health." (London, Nov. 18th, 1873.)

But we have not only these expressions of opinion on the part of experienced officials, but we have also what is still more important, viz., the emphatic declarations of medical practitioners who speak from actual experience of the disadvantage of a system which tends to weaken the bonds of sympathy between those of our profession who are engaged in curative, and those engaged in preventive work. I beg to refer especially to the letters which appeared in the *British Medical Journal* two or three years ago, when the question of the systematic notification of infectious diseases for the city of Liverpool was under discussion. You will there find medical practitioners strongly urging that officials wholly disconnected from practice lost touch with those engaged as practitioners; they lacked, to use Professor Gairdner's words, "the very human knowledge and human sympathy of a doctor"; that their tendency was to look at questions exclusively from the official standpoint, and to make light of those difficulties which those who have a practical knowledge of disease, and of the circumstances in which the practitioner is placed, can alone appreciate. In pamphlets and reports which appeared at the time particular attention was invited to the fact that at Huddersfield, where the Notification system worked most smoothly, the Medical Officer was engaged in practice; and it might also be noted that the same was the case till lately at Leicester, where the Authorities are so justly proud of their notification and its results, and where the Town Council has shown itself specially ungrateful to the late Medical Officer of Health who has rendered it such essential service.

But, of course, everyone of experience will admit that there is a very great deal to be said on the other side of the question from the purely professional point of view, and some of the principal arguments on either side may be set out with advantage by repeating in substance a conversation between two officials. The one devoting his whole time to official duties I will call by the title he prefers, namely, "Health Officer", and the other, "Medical Officer", and for brevity, H. O. and M. O.

H. O.—I am of opinion that the time has come for making a speciality of "hygiene", or "sanitary science", and on this ground alone, and apart from other considerations, all who enter the Sanitary Medical Service should be required to have been

specially trained, and to have passed an examination in hygiene; and that in order to keep himself abreast of the knowledge of the day, the Health Officer should give the whole of his time to public duties.

M. O.—I will also assume that the conditions are such as to render it possible for him to earn a living and to make provision for the future by devoting his whole time to public duties. I fully agree with you that anyone undertaking sanitary duties should have a good general scientific training, and that he should cultivate those branches of science which immediately bear upon his work. But I dissent from the rest of your proposition; and I would commence by asking you in what sense you use the word speciality, as applied to the study and practice of what has come to be called the "sanitary science" or "hygiene"?

H. O.—The term "sanitary science" includes the study of chemistry and physics; the methods of analysis of air, water, and food (microscopical as well as chemical); the laws of heat, and the principles of pneumatics, hydrostatics, and hydraulics; the laws of the realm relating to public health; vital or sanitary statistics; the origin, propagation, pathology, and prevention of epidemic and infectious diseases.*

M. O.—This is rather a wide scope for a "speciality" in these days, in which we read of "coleopterists", and even "scarabæists". What then are the practical applications of this extensive field of knowledge in sanitary science?

H. O.—As regards chemical and microscopical analysis there is an immediate application of knowledge in the constant need for scientific examinations of water, food, and air.

M. O.—I admit that in country districts the ability to make these examinations is of great practical utility; but you must remember that the tendency for people in England is to aggregate in large towns, and that there you find professional analysts who devote themselves entirely and uninterruptedly to the pursuit of this branch of knowledge, and who will, generally speaking, be more entitled to be considered chemical experts. I do not, of course, refer to the rare instances in which Health Officers are also recognised authorities on food or water analysis, etc.

H. O.—As regards the knowledge of physics which his training requires him to possess, he will find many opportunities for its appli-

* It will be seen by reference to the *Medical Directory* that this is the order in which the subjects for the "Sanitary Science Certificate" examination are placed.

cation in advising upon questions of house construction, sewerage, sewage disposal, and water-supply.

M. O.—In what manner is his special knowledge on the question of house construction to be utilised?

H. O.—He has, in the first place, to advise the authority on the bye-laws relating to new buildings.

M. O.—True; but are not the principles on which these bye-laws should be constructed well understood? Are they not fully set out in the "Model Bye-laws of the Local Government Board"?* Is not their application to particular cases rather a matter for the surveyor than the medical officer? It can only be in very exceptional cases that the assistance of the latter officer is required. In what other directions will his knowledge of house construction be useful?

H. O.—He will often be called in where illness has occurred in a badly drained house, and he will be expected to discover the defects, and to advise the architect or builder as to the appropriate remedy.

M. O.—Now it seems to me you are trespassing perilously near the domain of a profession distinct from our own. I am aware that architects, especially those of the old school, are sometimes glad of the advice of the Medical Officer in matters of house construction —drainage, warming, and ventilation,—but the younger members of that profession are more entitled to be considered experts on these questions than we can claim to be. I speak now of the ordinary Medical Officer of Health, and my remarks do not, of course, apply to those who have made the question of house construction their especial study, and who, being recognised authorities on the subject, are consulted as any other specialist is consulted. In the same way, with regard to sewage disposal and water-supply, there are now amongst engineers and chemists those who are regarded as specialists in these particular directions. Public bodies who contemplate the spending of large sums of money on works of this kind will generally prefer to consult such experts. We very seldom hear of the Medical Officers for large towns being consulted on such subjects by their Corporations, although, in certain instances, purely medical knowledge is of great value in the counsels of the Authority; and this fact ought to be more fully recognised by public bodies.

H. O.—Then you must remember that the Health Officer has to make himself master of all the Acts of Parliament relating to sanitary administration, and his attendance in the police-courts is frequently required.

* Knight's illustrated copy of the "Bye-laws" is here referred to.

M. O.—In questions of law the Medical Officer had better not assume the responsibility which belongs to the clerk of the Authorities, who is their legal adviser. In his reports, the Medical Officer often has to urge the alteration, improvement, or strengthening of the law; but this is an entirely different matter from the interpretation of the law. It is a mistake for him to assume too much responsibility in this direction. Then, as regards attendance in courts of law, the purpose for which this is required should be clearly defined. The position of the Medical Officer is that of a scientific witness, and he should be very careful not to abandon that position. There are, I know, exceptional instances of Medical Officers possessing those qualities which contribute to success as an advocate, and which enable such a man to state a case, especially one which involves medical or scientific considerations, more clearly even than his legal colleague. But if he ever does so appear in courts of law, he must be careful not to leave the impression that his office is essentially that of an advocate or prosecutor. His real position is that of a scientific witness, and, as a general rule, he should adhere to that position strictly. If he does so, the occasions in which his presence will be required in police-courts are not so very frequent.

But pray tell me something medical in which your speciality is useful. You have mentioned points in which special knowledge is required, but I fail to see the exclusive claim members of our profession can have to the title of "Health Officer", or why an intelligent lawyer, surveyor, or chemist, should not compete with you for the office.

H. O.—I do not agree with you so far, because I consider that a medical training is of use even in the acquirement and application of such knowledge as that to which I have referred; but as you twit me with investing the Health Officership with functions essentially non-medical, I will ask you, whom I recognise to be as earnest a sanitarian as myself, what possible connection can there be between the tracing of a milk epidemic and the diagnosis or treatment of diabetes? between the clinical observation of a case of pneumonia and the arrest of a small-pox epidemic? between the treatment of a case of diphtheria or diarrhœa and the prevention of its cause?

M. O.—Now you are carrying the war into my camp. And though I think it rests with you to make good your own position, I will not decline your challenge, and will answer your questions with the same frankness as that which you have displayed. The

diagnosis and treatment of a case of diabetes is a fair instance of the kind of work which a practitioner performs, and which is wholly removed from such a public duty as that of tracing and stopping a milk epidemic, should such an event happen in the town or district which he serves as Medical Officer. The tracing of an epidemic to its source requires an aptitude which the ordinary practitioner does not usually cultivate, but which must be cultivated by anyone holding the post of Medical Officer of Health. But why should you object to the same man using his chemical apparatus to detect and estimate quantitatively sugar in the urine of a patient, when you have just now insisted that the Health Officer of the future should be accomplished in the use of such apparatus for the purpose of examining air, water, and food? The work is far more useful for any one having had the advantage of a professional training to engage in than that which I am told some Health Officers have undertaken.

Take your next illustrative case. I think that the observations at the bedside and in the *post-mortem* room are those upon which we must always depend largely in our study of the causes of disease. The clinical observer keeps his mind open upon all questions of etiology, and he records facts, not only with regard to the character of the disease, but with regard to its possible causes. The necessary connection between the clinical characteristics of disease and its causes is recognised as a rule by the "Collective Investigation Committee". I remember hearing at a public meeting one of the most distinguished physicians of the day positively assert that pneumonia was frequently caused by sewer-air. I wondered at the time upon what scientific observations he based his strongly expressed opinion. Such a point as this should be investigated by Medical Officers in the way that the etiology of enteric fever has been investigated; and pray how will they get full opportunities for investigation if their connection with hospital work is severed, and if they cease attendance at the bedside of the sick?

The arrest of a small-pox epidemic, which you place in a position of contrast to what you wrongly consider non-preventive work, illustrates again the peculiar danger of the kind of specialism which you are advocating,—I mean the danger which comes from regarding our knowledge as complete. This is a danger in the practice of curative medicine; how much greater must it be in the new science of preventive medicine!

One of the measures of prevention which Health Officers have strained every nerve to secure is the seclusion of the sick from the

healthy, and their aggregation in hospitals. At this very day the question is seriously raised whether this aggregation of the sick may not itself give rise to the peculiar quality which we speak of as epidemicity, and whether the influence so created may not extend indefinite distances in the air. Upon such a point as this the Medical Officers of Health, who are the scientific watchmen of their districts, should have a great deal to say. But for the purposes of my present argument it is sufficient to point out that, by assuming that the hospital isolation of small-pox is essential as a preventive measure, he is in the worst possible mental attitude for one who should be a scientific observer.

H. O.—There is much in your argument which, as a medical man, I cannot fail to appreciate, though I am doubtful whether your reasoning would convince the members of corporations and local boards. You must remember that scientific observation and research are not popular, and that it is the people who elect the corporations, who are our masters. But tell me what you have to say to my last illustration! Take, for example, the preventable diseases, diphtheria and diarrhœa: in what way is their treatment allied to their prevention? We prevent diphtheria by detecting unhealthy conditions of drainage, and replacing them by healthy conditions; and we study the causes of diarrhœa by marking on maps the cases as they occur, and by making meteorological observations and elaborate inquiries into the conditions of the soil in the localities where it prevails. This work is quite outside the sphere of the medical practitioner's ordinary work.

M. O.—I do not see why it should be. The medical practitioner, who is a Medical Officer of Health, will report upon defects of drainage and give evidence respecting them; and he will also say that these defects are the cause of illness, if the evidence is such as to lead him to that conclusion. But in this instance you are again disposed to regard our knowledge as complete, and to ignore your principal function, viz., that of a scientific observer. The treatment of diphtheria cannot be separated from its prevention, inasmuch as isolation and disinfection are essentially necessary. Then, are you able to say that in most, or even many cases, the disease is due to the drains? Do you not remember the North London epidemic of throat illness, which was for a long time attributed to defective sewerage, but which proved to be coincident with the distribution of a milk supply from diseased cows? While, therefore, your attention is fixed on the drains, the disease may be distributed by some food

supply which requires investigation. The causation of infantile diarrhœa is also a matter for clinical, pathological, and biological investigation, and many are of opinion that it is from this point of view that the subject needs to be studied at the present time.

I also see no inherent disadvantage, but quite the contrary, in a scientifically trained member of our profession, as a Medical Officer of Health should always be, devoting some of his attention to questions of meteorology, soil, condition, etc., in districts which are noted for the prevalence of certain diseases.

I am tempted to spin out this conversation between two representative officers, but considerations of time warn me that I must at once proceed to what may be considered the more practical aspects of this question. I will assume, therefore, that the professional arguments on both sides are equally balanced. I shall now endeavour to show that, as a general policy, apart from the above considerations, the "whole service" system in medical health appointments is opposed to the highest public interests, except in the case of very large cities and combined areas, for the following reasons:—

1. Because the public would, if certain recommendations of the Commission were adopted by Parliament, be deprived of the services of a class of medical experts such as those who have, in the past, largely contributed to scientific knowledge in the prevention of disease, as men of this class could not be expected to sacrifice everything for a profession in which the usual incomes are very small and precarious, and which, as a profession, may be said to be without prizes.

2. Because, among the towns and districts which have obtained the services of medical experts, there are many which, in the present state of public opinion, are evidently not sufficiently large to need them, as is clearly shown by the fact that the officers have undertaken, or had imposed upon them, duties which do not require any professional knowledge, and which might be performed quite as well, and at less cost to the public, by non-professional persons.

3. Because the insecurity of tenure makes it exceedingly difficult for a Medical Officer of Health, who is cut off from all other means of earning a livelihood, to discharge his duties with sufficient independence; and this want of proper independence would be specially felt in cases where the Authority was largely composed of small property owners who were opposed to sanitary work.

I will now briefly discuss these reasons.

1st. The public would lose the services of those who have done so much in the past, and, under favourable circumstances, may do more in the future, for the advancement of knowledge in matters relating to the prevention of disease. Let me illustrate this point by referring to the work of some of the many distinguished Presidents and members of this Society.

On the retired list is the name of the first Medical Officer of Health for the City of London, a pathologist of world-wide reputation, also a surgeon and teacher to one of the great medical schools. No brighter example could be found of one who was a most distinguished public official, and at the same time engaged in private practice.

Another famous physiologist, biologist, and pathologist, whose works on diphtheria, public vaccination, the communicability of cholera to animals, artificial tuberculosis, the intimate pathology of contagion, bacteria, pyæmia, and the acute infective diseases, have an immediate bearing on our every-day work, was the Medical Officer of Health for one of the London parishes.

One of his cotemporaries was at the same time a most earnest sanitary worker, and a physician whose works on the diseases of the skin were well known.

Amongst those who have presided over this Society during the thirteen years that I have been a member, was another Medical Officer for the City of London, whose name must have been almost as familiar to the judges and advocates in our High Courts, and in the Parliamentary Committee-rooms, as that of a well-known Medical Officer of Health and chemist who at the present day so frequently gives evidence in sanitary cases.

The present Medical Officer to H.M. Local Government Board, an ex-President of this Society, was the former Medical Officer of Health for a very poor and densely populated London parish. His work on the "Lung Diseases of Children" was well known; and his works on "Typhus Fever", "English Hospitals in their Sanitary Aspects", and "The Relation of Phthisis to Soil Moisture", may be said to be strictly cognate to that of a Sanitary Medical Official. No one could say that this eminent representative of preventive medicine was wanting in zeal as a sanitarian, when he was engaged in private work as a consulting physician.

Another former occupant of the chair was a chemist of high repute, a lecturer at one of the principal schools, an authority on toxicology and medical jurisprudence, a university examiner, and an

analyst, not only for the district which he served as Medical Officer of Health, but for many other districts besides.

Another ex-President of this Society has been for thirty years the Medical Officer of Health for a large London parish, and his mature judgment is recognised to be of high value to us all. He is chiefly known as a great clinical observer, the author of one of the most widely-read books on the theory and practice of medicine, and he at the present time occupies the chair at the Pathological Society. But from his teaching of medicine, we, who were his pupils, learnt to study the distinctive characters and etiological facts about diseases even more closely than the treatment of their symptoms. He is also the writer of works on the manufactures and occupations which cause disease, on the hospitals of the United Kingdom, on the relation of the birth-rate to the death-rate, and on the morbid anatomy of the cattle plague; whilst amongst his valuable reports to the Vestry there is one which deals with the housing of the poor, from the standpoint of a hospital physician, and one who through his life has been familiar with their sufferings. I feel I express the unanimous opinion of all Medical Officers of Health when I say that a policy which would rob the public of the services of such a distinguished medical sanitarian would be disastrous.

Then there is our late President, with regard to whose opinions on this important question I am not clear. He is the Medical Officer of Health for a parish which is one of the largest and most wealthy in London; a district, moreover, in which the inhabitants appear to be fairly appreciative of professional sanitary work. But I have been a reader for many years of the very able and instructive reports which he has constantly issued, and throughout his career as a Medical Officer of Health I have observed that, so far from confining his attention to the district which he serves, his remarks and observations relate to all London, and, I may even say, to all urban communities. Moreover, in an important sanitary case in which I was a short time ago subpœnaed as a witness, I noticed that our immediate ex-President was engaged in assisting with his professional advice the counsel on one side; and as I apprehend this was not done entirely without fee or reward, he could not consistently speak as the advocate of "whole service", which absolutely prohibits all private remunerative work? I think, therefore, I must claim him as a supporter, for surely he would object to having his sphere of usefulness fettered by such restrictions as those which the Commission recommends.

In the case of the present occupant of our presidential chair, I am furnished with another conspicuous example of the way in which the Medical Officer of Health may, with advantage, be engaged in private work, often of a cognate kind. For he is not only the adviser of a Sanitary Authority, but also a teacher of hygiene, a university examiner, and a well-known popular exponent of sanitary principles as affecting questions of public health.

I might, if time allowed, continue these illustrations by citing instances of members who have lent lustre to this Society, and who have so successfully promoted the cause which we all have at heart; but, though unable to do this, I am unwilling to quit this part of my subject without referring especially to the great advantage the public derive from the valuable experience which sanitary experts gain from their opportunities of private practice in work which is cognate to their public duties. In a branch of scientific knowledge, which is rapidly growing, and which immediately affects not only the health, but also the pecuniary interests of the people, both directly and indirectly, the great value of experience ought not to require to be insisted on. It should be evident to all, that to compare the time of experienced officials who have done good scientific work, who can offer sound advice, or whose opinions have been frequently subjected to the searching test of cross-examination in courts of law, with that of young, untried men, who have obtained a medical qualification and have passed a special examination at Cambridge or elsewhere, as if they were of nearly equal value, is simply ridiculous. Nevertheless, those who advocate "whole service" as a general principle, do practically ignore this immense difference. Upon this point I have Dr. Tripe's permission to quote from a letter he has written to me, respecting this paper, a proof of which was sent to him. "There is one reason", says Dr. Tripe, "you have not referred to, why, I think, the Sanitary Authorities should not require 'whole time' from their Medical Officers of Health, viz., because he is then precluded, except on special leave, from giving the results of his experience at trials or in other ways. I have refused to devote my whole time here for that reason, and I have made a fair income as an expert in various cases, and in giving advice. In this way a Medical Officer of Health 'keeps touch' with others in his work." I have also received a note from my friend Dr. Dudfield (to whom also a proof was sent), in which he says "my views are very much in agreement with your own". Dr. Dudfield's views

are expressed in his admirable addresses and papers on Metropolitan Sanitary Administration.

I now proceed to discuss the second point, viz., that in many cases in which Authorities have obtained the whole services of professional men as Health Officers, those gentlemen have undertaken, or had imposed on them, duties which were of a non-professional character.

This is not the time to discuss what are the specific duties which a Medical Officer of Health may be expected to perform—though upon this point I think Sanitary Authorities would often be glad of information*—but rather to point out the duties which he ought never

* Although it is not my present intention to discuss the nature of the duties which a Medical Officer of Health may, with advantage to the public, be called upon to perform, I am glad to embrace the present opportunity of reproducing portions of a report which I furnished the Health Committee of an important Corporation two years ago. The Committee was about to make certain recommendations to the Corporation, respecting the duties and terms of appointment of a new Medical Officer of Health, and before doing so they did me the honour to request me to state my views on the subject. After referring to the relation of the Inspectors of Nuisances, and those appointed under the Food Adulteration Act, to the Medical Officer, and also to the duties which devolved on him in connection with the preparation of reports, etc., there occurred the following passages :—"The Medical Officer *is by the terms of his appointment an adviser of the Sanitary Authority.* In order to give advice that may be trusted, it is obviously necessary that he should be fully acquainted with the difficulties surrounding the questions upon which it is his duty to advise. These include such questions as the character of the nuisances to be taken under the Sanitary Acts, and the way in which they should be dealt with; the drainage, sewerage, and methods of dealing with the sewage; the public water-supply; the regulations relating to new houses and the laying out of new streets; the methods of dealing with infectious diseases; the action of the Authority with regard to offensive trades; school sanitation and health regulations; and occasionally questions of imperial legislation which closely affect the health of the people. Upon such questions as these the Medical Officer will be called upon for advice, and his advice should be regarded as that of a reliable and responsible person. It is clearly right that it should be so, for upon him there must devolve a considerable share of the responsibility for the action of the Authority. This is well exemplified in the case of dangerous infectious diseases. If an epidemic arises or spreads through want of something which the Medical Officer might have done or said, he is the person principally responsible in the eyes of the public. The same is true in a minor degree with regard to other matters in which responsibility is more diffused. It is therefore evident that upon matters concerning the Public Health the voice of the Medical Officer should be heard, and his views carefully considered in the counsels of the Corporation. . . . . He will also have other important duties. As a Medical Officer of Health of a large and important borough he will be desirous, for the credit of the town which he represents, of adding to that scientific knowledge which forms the basis of action for Sanitary Authorities. Knowledge of this kind is progressive, and it is of the utmost importance that Medical Officers who have the opportunities of observation should be able to use them, in order that we may know that we are working in right lines, and that money is not expended in the wrong direction."

to have had imposed on him. I am saved from the necessity of doing more than calling attention to those duties which have been named by Mr. Armstrong, in the paper to which I have previously referred, as being in some cases undertaken by the Medical Officer of Health. They are—"Superintendent of Cleansing", "Inspector of Nuisances". In the same paper reference is made to the unequal remuneration afforded to the Medical Officers, as compared with that given to other professional men —that given to the Town Clerk for his whole services being about three times that given to a member of our profession for his whole services. This distinction is more invidious and remarkable in cases where the Medical Officer is an undoubtedly able and experienced man, and it may account for the uncomfortable relations which are reported to exist. But I think that the writer of the paper which appears in last year's *Transactions* will agree with me when I say that if the Medical Officer undertake work such as that which has been indicated, and which can be done as well, or better, by a non-professional person, he forfeits all claim to be considered on a footing of equality, not only with the legal and engineering advisers of the Corporation, who are generally men of high standing in their respective professions, but other members of his own profession, to whatever branch they may belong. There is no doubt that we, as a body, have suffered materially from the excessive zeal of some of our members; and many of us will have noticed, with sincere regret, the answers given by one of our most esteemed colleagues to certain questions addressed him by the Chairman of the Royal Commission, which made it appear that it was the duty of the Medical Officer to measure the rooms of registered houses, to allot the number of persons to each room, and to serve the notices relating to structural alterations, cleansing, and the like; whereas, of course, this is the work of the Inspector of Nuisances, acting under the supervision of the Medical Officer of Health. I refer to this in the same spirit as that in which I alluded, a few years ago, to the course adopted by another highly esteemed colleague in undertaking duties which should not have belonged to him.

I have before me a still more delicate task in attempting to criticise the utterances of those most estimable persons who, by their disinterested labours, have gained the privilege of being regarded as the natural instructors of the people on everything pertaining to sanitary reform and administration. Foremost among this group of benevolent philanthropists stands the conspicuous figure of Mr.

Edwin Chadwick, C.B., the veteran sanitary reformer, who is never weary of endeavouring to lengthen the span of human existence by preaching the "gospel of cleanliness", and whose utterances, however dogmatic, may, therefore, be considered by some as being above criticism. But glad as I should be to avoid all reference to the opinions which the "Father of Sanitation" expressed before the Royal Commission, there are considerations which render this impossible. For not only would my paper be strikingly incomplete without reference to those opinions, but it is probably felt by many of our number that the particular expression quoted in the Commission's report, where the arrangements under which by far the larger number of the members of this Society (of which Mr. Chadwick is an honorary member) hold their appointments, are stigmatised as "most mischievous", is not only unjust to ourselves, but also to the public bodies which we serve. It may, indeed, be possible that Mr. Chadwick's sweeping condemnation was only intended to apply to those engaged in what is called "general medical practice", and that he would not include under the term "private practice", remunerative work of another sort. If it was his intention to be understood as objecting only to a particular kind of private work, it is most unfortunate that he did not express himself more guardedly, as it is clear that the Commission understood him to be advocating "whole service", for in this connection there appear in the report the words "uninterrupted time". Throughout my paper I have got rid of this ambiguity by speaking always of "whole service", which system, if it were adopted universally, would dispose of more than three-fourths of the present Medical Officers of Health, including most of those who are recognised to be among the very best, and which, under present conditions of local government, would, in the case of many districts, be utterly impracticable, and in most others would give rise to dissatisfaction on the part of employers and employed. There is ample reason, therefore, why I should not omit altogether a criticism of this remarkable evidence, though it is difficult to perform such a task with the consideration due to Mr. Chadwick, and at the same time with justice to the views I am representing.

I shall allude very briefly to that portion of the evidence referring to the horrors arising from the retention of the dead in overcrowded houses. It is an evil which we all recognise, and one which admits at least of partial remedy; it is therefore gratifying to know that Medical Officers (under whatever arrangement they have held their

appointments) have used their influence and exerted themselves to supply a practical remedy for this terrible evil by securing the erection of mortuaries in crowded districts, and thus relieving overcrowding of some of its most ghastly horrors. The answer to question No. 13,934 also bears reference to the same subject, and in it there is shadowed out a scheme for a preventive service, which it is difficult to understand, but which I believe is intended to be based on the occurrence of deaths from all kinds of infectious diseases. If I rightly understand the proposals, they would, I am sure, excite the very strongest opposition on the part of those who, very properly, require clear proof of the beneficial results that are expected to accrue from the domiciliary visits of public officials; and, to speak plainly, I am of opinion that if an official were to attempt to carry out Mr. Chadwick's suggestions in this direction, his freedom of action would most probably be very suddenly arrested. I also feel that it would, perhaps, be out of place to refer seriously to the way in which death-rate statistics were made use of before the Commission. Some of us who, as a rule, faithfully follow the instructions laid down for our guidance by the late Dr. William Farr, may be conscious that at exceptional times—as, for instance, just before and after the adoption of an improved water-supply or sewage-disposal scheme in our districts—we have neglected his teachings, and, abandoning the strictly scientific use of death-rates, have not shown, in the choice of periods for which the death-rates are calculated, that strict impartiality which might be expected of us. We have thus been able to excite the enthusiasm of a large meeting by showing a most marvellous and instantaneous reduction of the death-rate on the adoption of our Sanitary improvements. It will be remembered that at a memorable meeting of the Pickwick Club, an honourable member, in the heat of controversy, applied an epithet the reverse of complimentary to its immortal founder, and that upon being called to order, he explained that he used the word in its Pickwickian sense, and that it was merely intended to bear a Pickwickian construction. In like manner it is just possible that if at some future time an honourable member of this Society is called to account by some high authority for an outrageous misuse of death-rate statistics, he may urge in self-defence that he was only using them in a certain well-understood sense, and that they were merely intended to bear that construction.

But although I refrain from discussing in detail, or too seriously, the bulk of Mr. Chadwick's evidence, there is one answer which I

must reproduce verbatim, because it illustrates most remarkably three points for which I am contending in this paper, viz.: (1) the necessity for keeping prominently before the public the fact that we are the advisers of the Sanitary Authority, especially upon the medical aspects of sanitary work; (2) that without medical knowledge the most veteran sanitary reformers may propose schemes which are quite impracticable; (3) that the idea of "whole service" for small districts originates in a misconception of the duties that a Medical Officer of Health may, with advantage to the public, be expected to fulfil.

"*Q.* 13,942. There are districts in London where as many as six inspectors are employed, against one inspector in other districts of the same population, are there not?—*A.* Yes; and that requires to be strengthened by the operation of another provision than that which I have mentioned, of getting the Officer of Health into the room and not only removing the body, but reporting on the conditions to be remedied. One other provision that we much want is that the Health Officer should regularly, not less than weekly, examine every school. In examining that school he will detect in an instant the incipient cases of eruptive disease. He will say: 'This child has premonitory symptoms of this, that, or the other disease, and it must be removed; it must go home; I shall go home with it, and see to its home and the condition of things there.'"

I have shown the above paragraph to many members of our profession, and they all agree that from Mr. Chadwick's tone of extreme confidence in referring to purely medical questions (which, with all possible deference to him, I am bound to say he evidently does not understand), it is possible that he may conceive that a medical training is unnecessary for a Health Officer. Indeed, the main qualifications for the post would appear to be physical activity and energy: for it is clear that the walking capacities of this ideal official would approach the marvellous. Let us imagine the typical Health Officer of Mr. Chadwick's creation starting on his Quixotic expedition.

He would, I suppose, first consult a medical text-book to find out what were the "eruptive diseases" and what were their "premonitory symptoms". He would not find any very distinctive premonitory symptoms which would enable him "to detect in an instant" an "incipient case" of scarlet fever, for example. Headache sometimes occurs in the incubation period of this disease, and as we are told by Dr. Crichton Browne that this is a very

common complaint among under-fed and over-worked school children, he would be very actively engaged in walking to and from the schools. Then how would the parents receive him? and what would the School Board have to say on the subject? He would again consult his medical book, and find that measles was ushered in by symptoms very much resembling those of an ordinary cold in the head. But let us suppose that he started off with a child so affected from one school, and, to save time, picked up a child from another school complaining of headache, he would be then confronted with a fresh difficulty: for measles being, undoubtedly, infectious during the premonitory stage, he would have rendered himself liable to a penalty of £20 for wilfully and knowingly exposing the second child to infection. Then supposing he turned his attention to the premonitory symptoms, if they may be called such, of typhoid fever, and pounced upon every child complaining of headache, malaise, or suffering with diarrhœa; he would have read that to walk a child about the streets in such a condition was decidedly prejudicial; and if his feelings of humanity prompted him to take a conveyance, he would be perplexed with all sorts of doubts as to whether he was right in allowing the same conveyance to perambulate the streets without disinfection; and if he suggested such a thing to the cabman, he would find he was expected to pay as much as would amount to his earnings for a whole week.

Let me, before finally dismissing this part of my subject, very briefly consider Mr. Chadwick's suggestions as to the duties of a Health Officer from another point of view. "The Health Officer should regularly, not less than weekly, examine every school" (that is, I presume, every child at school). Now what would this entail in the way of expense to the ratepayers? There are, I believe, forty Medical Officers of Health for London: if London were officered upon the system which the Royal Commission recommends, and which is carried out at Glasgow and Birmingham, instead of forty there would only be eight Medical Officers; but if duties such as those which Mr. Chadwick shadows out were assigned to the Medical Officers, then not eight, nor forty, nor yet two hundred officers giving "their uninterrupted time" would suffice for London.

It is plain, therefore, that there is much confusion of ideas on the subject of Medical Officers' appointments and duties amongst those who advocate whole service, and that we who argue that on public grounds this is undesirable, save in exceptional cases, have only to point out that the important duties of Superintendent of Cleansing,

Inspector of Nuisances, Assistant-Inspector of Nuisances for measuring rooms, and that of examining schools on Mr. Chadwick's system, do not devolve on the Medical Officer of Health.

I must now briefly refer to the third reason which I have advanced against the acceptance of recommendations of the Royal Commission. It is based on the fact that the small salaries, without prospect of pension, combined with insecurity of tenure, militate against the proper independence of Medical Officers of Health. I know that it is often argued that the private practitioner is less independent than the whole-service officer, and this may be sometimes the case; but from my observation I should say that the contrary is more frequently true. Supposing, for example, in a town of 100,000 inhabitants a salary of £400 per annum is accorded to the Medical Officer (a rate of remuneration above that which most towns can afford to pay for medical sanitary work at the present day), is it reasonable to suppose that a Medical Officer, on the whole-service system, whose salary is his only means of subsistence, will be more likely (than a public officer with other resources) to risk offending members of his Authority, or influential owners of property, who may render his position so uncomfortable as to be untenable at any moment? and is not the position of a good class practitioner of high standing and much influence far more independent and useful to the community? The fact is, that many Authorities have discovered that the very way to have a Medical Officer under their thumb is to secure his whole services, with insecurity of tenure. Let me remind you of the events which occurred a few months ago. One of our most valued colleagues had given evidence before this very Commission which gave offence to the Authority that he served. Now, supposing the Authority, in revenge, were, in such a case, to say, "We shall adopt the whole-service system which is recommended by the Royal Commission. We shall require you to devote all your time to your public duties as Medical Officer of Health. The salary of course remains the same: it is as much as we can afford: and we think it is sufficient for the work that we require." And supposing an able and experienced Medical Officer were willing to place himself in the power of such a body, what would be his position? He would be absolutely prevented from adding a penny to the income of his office. If he undertook any other remunerative work, his conduct could at any time be represented in the most odious light. If he dared to open his mouth where high interests—that is, the interests of some of his employers or their friends—were concerned, his life

could be made a burden to him by acts of petty tyranny which an officer with other resources would rather resign his office than submit to. Can any more clever device be imagined than this for destroying the proper independence of an officer, and effectually preventing his ever saying inconvenient things? I commend this aspect of the question most seriously to those who urge the indiscriminate adoption of the whole-service system.

Here let me interpolate the concluding paragraph of Dr. Gairdner's famous letter, to which previous reference has been made. It reads thus:—"The risk which a medical officer of health runs is not, in my opinion, so much that of the interference of his public duties with private practice, as the risk of his being ill-used by those placed in authority over him; and from this he is, to a considerable extent, protected, if, through a successful private practice, *or through other sources of emolument*, he is enabled to perform his sanitary duties so long as he is well supported, and to demit them when he ceases to be so."—*Lancet*, 1872, vol. ii, p. 934.

I could continue this argument at great length, but I must now conclude with a few general observations. I have throughout guarded my remarks by saying that with the *present areas and present conditions of Local Government* whole-service appointments are very rarely desirable. The case of the great cities may afford occasional exceptions, and the admirable working of some of the combined districts afford other possible exceptions to the general rule. But, alas! in the case of these, we know that very few of these appointments are permanent, and that combinations have sometimes broken up, and the Medical Officer has been ruined. We have even been told that in one instance in which the combined Authorities were anxious to make their appointment for five years, an unlooked-for obstacle occurred in the refusal of H.M. Local Government Board to give their consent to the term of appointment being for more than three years. The position of the Imperial Government in these cases is this: that as half the money paid to the Medical Officer is repaid from the Imperial exchequer, the Local Government Board controls the tenure of office. The attitude, therefore, of the Board towards Medical Officers of Health is a matter of the greatest importance. I will therefore prefer to quote, from the report of last year's *Transactions* of this Society, Mr. Jacob's remarks, which appear on pp. 60, 61:

"Mr. Jacob agreed with a good deal that Mr. Armstrong had said, and felt all that the President had remarked as to the tenure of

office. The office in combined districts was most insecure. The district was sometimes broken up, and the Medical Officer felt, under these circumstances, that, although he might be re-elected over and over again, he was fettered in the freedom of the advice he should give and the remarks he should make. He thought the Local Government Board were largely responsible for committing the Authorities to appoint only for a time. *In his own appointment it was proposed to elect him for five years, but the Local Government Board would not consent, and he was elected for only three years.*"

We all know the energy, ability, and enthusiasm displayed by Mr. Jacob in his official work on all occasions, and it is most discouraging to hear of the Central Board being unwilling to give effect to the wishes of the local ratepayers, and to place their medical officer in a position in which he would be able to discharge his duties with sufficient independence.

I have not referred to the proposed restriction recommended by the Commission with regard to place of residence, because this is, in my opinion, merged in the much larger question of whole service. Such a restriction would make combined appointments impossible, and every little village and town would have to appoint its own Medical Officer. In London, also, the restriction seems specially uncalled for. Here, Medical Officers are frequently consultants, engaged in work cognate to their public duties; and it is essential they should live in central localities for the exercise of their profession. The facilities of locomotion within the metropolitan area, especially from centre to periphery, are better than anywhere else, and there cannot be the smallest difficulty in Medical Officers reaching any part of their districts in a very short space of time.

I have also not referred to the advisability or practicability of the Medical Officer holding other public offices, such as analyst, coroner, or registrar of births and deaths, for the simple reason that, unless these appointments are combined with his own at the outset, there seems very small chance of his obtaining them afterwards, and in any case he would come into competition with members of other professions, viz., lawyers and professional chemists; and unless he showed superior qualifications for the posts, his appointment would not be justified on public grounds.

The advice that I would urge those who are consulted by sanitary authorities to give is this : Appoint men with good scientific attainments and of good standing in their profession, and pay them fairly

for the time and attention they must give to their public duties. The higher their position and the greater the reputation they have to maintain, the more certain they will be, as a rule, to perform their duties earnestly, conscientiously, and with judgment. Unless you are prepared to give your medical officer a position as good, or nearly as good, as that which you give your legal adviser, or your engineer (assuming these officers to be on the whole-service system), do not hamper the appointment with restrictions which, even if they may seem to be desirable in theory, do not answer well in practice.

Discussion.

Mr. Armstrong (Newcastle), in opening the discussion, said that the paper seemed to him to be inconsistent with itself in different parts. He himself held views opposed to those expressed by Dr. Seaton, and so had Dr. Seaton at one time. He maintained that the Medical Officer of Health could not leave all legal, chemical, and engineering questions to the other officials of the board ; for, if he did, not much would be left to him, and he and his work would be little thought of. If the Medical Officer did not actually undertake these collateral duties, he ought to be able to guide and criticise the performances of those who, though colleagues, hold in some sense subordinate positions. Thus, while leaving it to the veterinary surgeon to determine the nature of the disease of which an animal had died, he should decide as to the unfitness of its flesh for human food; and while referring the examination of a suspected water to a professed analyst, he should reserve to himself the right of pronouncing on that and other evidence an opinion of its wholesomeness, or otherwise. Even in his relations with medical men this position should be maintained, for a practitioner, though he might suggest or indicate the probable origin of an epidemic, could not carry out investigations demanding local inquiries and travelling from one place to another. Such work could not be undertaken by a man in general practice, and this was a strong reason why the Medical Officer of Health should not be a general practitioner. Besides, such a man was always liable to come into collision with his patients, actual or potential, on the board and out of it. These difficulties were not so likely to present themselves to a purely consulting physician, to whom, if he had the special training which he maintained was essential to the proper performance of the duties devolving on the Medical Officer of Health, there could be no objection.

Dr. C. E. Saunders (West Herts) did not think that the recommendation of the Royal Commissioners, that the Medical Officer of Health should reside within a mile of his district, referred to any but those of the metropolis and large towns, since, otherwise, combined districts would be rendered impossible. He was the officer of a large area, and had succeeded to two who had resigned through fear of giving offence to their patients, and the ill-will of neighbouring practitioners.

Dr. Swete (Droitwich C.D.) had no practice himself, but he had been much thwarted by what he called the "five pound" Medical Officers of Health, as in reporting on nuisances caused by farmers who chanced to be their patients. Many of these Medical Officers were paid next to nothing, and were expected to do as little. At one time he lived forty miles from his district, and, though now nearer, was still in every way perfectly independent, and his board knew it. He demanded for all the three F.'s—fixity of tenure, fair pay, and freedom of action. On one occasion his board wished to make his appointment for life, but the Local Government Board would not allow it to be for more than three years. He had, however, been re-elected without opposition until the last time, when certain members of the board to whom he had made himself obnoxious in the matter of polluted wells, brought forward, unknown to him, two of the Medical Officers he had alluded to, and he had narrowly escaped being superseded. He thought that the Medical Officer of Health should exercise his supervision over an entire county, except, perhaps, some of the largest, which might be divided into two or three divisions ; and that the parish surgeons should receive a small salary for acting as Medical Inspectors under his direction in their respective districts. He did not think that the Medical Officer of Health should attend board meetings unless invited.

Mr. Wynter Blyth (Marylebone) considered the question of the combination of sanitary work with private practice as a wide one, involving that of specialism and the division of labour, to which most of the progress recently made in science and in art was owing, and in none more than in the profession of medicine. But he could see no objection to the Medical Officer of Health being at the same time analyst, or coroner, or holding any other honourable position not inconsistent with his special work. He might be a pure physician, perhaps with advantage; but general practice, with its attendant dispensing, bill-making, etc., was certainly incompatible. The eminent Medical Officers of Health referred to by Dr. Seaton as actively

engaged in practice would probably have been even more eminent had they been more free. He was certain that the etiology and spread of infectious diseases could be better studied from the independent standpoint of a pure Medical Officer of Health than by one engrossed in the cares of private practice.

Mr. Lovett (St. Giles's) said that his experience was decidedly against the combination of private practice with public duties. But it was a fact that he had had more trouble in his dealings with his professional neighbours than with the members of his board. He was of opinion that the Medical Officer of Health ought to attend the meetings of the board, and especially that he should read his own report.

Mr. Jacob (West Surrey) approved of combined districts, by which the boards really got the best value for their money, whereas the small ones were worth very little to employers and employed. He would suggest that not merely parish surgeons, but all medical men, should receive a fee, say a guinea, for every case of isolation of infectious disease, disinfection, and report. The Medical Officer of Health would then be free to devote more time to systematic inspection of his district, a work which was quite incompatible with general practice.

Dr. Bate (Bethnal Green) had found his influence over his own patients of use in getting work done; but, on the other hand, he confessed that he was rarely called in to cases of infectious disease, for fear of the expense to which they might be put in consequence.

The President, in summing up, said that there seemed to be a general consensus of opinion that Medical Officers of Health should not be engaged in general practice, and that the smaller appointments should be abolished. He reminded the meeting how much sanitary progress was indebted to the labours of the veteran reformer, Mr. Edwin Chadwick.

Dr. Seaton, in replying to the various speakers, considered that Dr. Swete virtually confirmed all his statements, but he could not agree with Mr. Blyth in describing the work of the Medical Officer of Health as a specialism, involving as it did a knowledge of medicine, chemistry, engineering, law, and a multiplicity of other subjects.

ON SUCTION OF SEWER-GASES INTO SERVICE-PIPES CONVEYING DRINKING WATER, A FERTILE CAUSATION OF ENTERIC FEVER.

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Medical Officer of Health for Droitwich Urban and Rural Sanitary Districts.

(*Read: January 12th*, 1886.)

Mr. President and Gentlemen,—There are, perhaps, few subjects of deeper interest to Medical Officers of Health than that of Enteric Fever, or, as it has been not inaptly termed by Mr. Simon, "Filth Fever".

I have not, however, to-night to bring before your notice those causes that are daily before us,—water impregnated with excreta, foul air from untrapped drains, or milk that has become charged with the germs of enteric poison,—but rather to show a danger that is, I believe, more frequent than is generally supposed, and which may account for the invasion of the disease in houses, so satisfactory in their general sanitary condition as to be almost fever-proof. In fact, after all our care, we may unwittingly be condemned to drink the filth of our neighbours, or even germs from an enteric case occurring some streets off.

I allude to the possibility—and, indeed, in large towns, frequent occurrence—of suction of gases from sewer-pipes in the streets, and from badly trapped sinks, or from empty water-closet tanks in our houses, into the water-service supply, when, owing to occasionally shutting off the water in the mains, a vacuum is formed in the water-pipes. Even without entirely shutting off the supply of water, an alteration of pressure will cause a vacuum to be formed in the highest point of the system of pipes, especially when, as in large houses, supplying several water-closets, housemaids' sinks, and baths, there is much bending or syphoning of the pipes.

Water is supplied to towns, either on the constant-service system, directly from an open reservoir, or from a standpipe, through which the water is continually pumped to attain a greater head for the higher levels of the town; or it may also, as it is still in a great

portion of the metropolis, be supplied to tanks for a certain number of hours in the day only.

Now, whilst in the constant-service system the danger is minimised, provided the current of water is really continuous, yet the necessity for shutting off portions of the water-supply for making repairs or new connections, or for flushing purposes, gives ample room for suction to occur. Besides this, when the water-supply falls short, as it has done to a very great extent during the past year, even the continuous-service system becomes intermittent for many hours during the day. This was notably the case last summer in Liverpool, Bakewell, Kidderminster, Buxton, and many other places.

Where the water-supply is intentionally intermittent, the danger is nearly always present in the street mains ; in many instances, to save expense, laid side by side with sewer-pipes, the water-pipe and the bend of the soil-pipe passing in and out of houses through the same hole in the wall.

Now this is no fictitious danger. Those of us who read the published reports of the Medical Officers of the Local Government Board can call to mind many instances of outbreaks of enteric fever that have been traced to this cause ; but it is, I think, a mode of causation that is not so generally in the minds of Medical Officers of Health as direct pollution of wells, foul sewer-air, or polluted milk.

I think Dr. Alfred Carpenter was the first to draw public attention to this point, in a paper published in 1873 in *Public Health*, on "The Danger of an Intermittent Water-Supply when delivered by House Services designed for use under Constant Pressure." In this paper he clearly points out the danger of suction from neighbouring sewage-pipes, in which the joints were, as too often is the case, leaky ; or from subsoil impregnated with sewage matter. At that time water-closets were commonly supplied with water directly from the service-pipe ; and he did good service in insisting, as is now generally the case, in having the closet fitted with a separate service-box with a ball-tap for the water-supply of the closet.

During the succeeding year Dr. Bloxall reported to the Local Government Board on the occasion of enteric fever at Sherborne, which he attributed to suction of sewer-gases from the closet-pans into the water-pipe which supplied the closet direct from the house service without the intervention of any separate cistern. Here he found the open mouth of the water-pipes inside the closet-pans, and when a vacuum was formed in the service-pipes, excrement was actually sucked up into the water-pipe.

But it was left for Dr. Buchanan, in the year 1874, reporting on the outbreak of enteric fever at Caius College, Cambridge, to demonstrate this matter in the most convincing manner. The whole report is a masterpiece of sanitary investigation, and one which will well repay any Medical Officer of Health carefully to study. I will, therefore, even at the risk of being prolix, describe this outbreak at some length. It was of especial interest to myself, as I not only knew Caius College well, but my brother, being tutor, remained in residence during the epidemic, and I heard from him the accounts of the progress of the disease almost from day to day.

Caius College, of which the entrance tower and new buildings form a prominent object at the top of the King's Parade, stands on a considerable plot of ground, surrounded by Trinity Street, Trinity Lane, a street separating it from Trinity Hall, and the passage between the College and the Senate House. It is necessary to mention these boundaries, as the manner in which the water-supply is distributed to the different courts of the College is important.

The College is divided into three courts; the first and largest at the entrance being Tree Court, is formed on three sides by the new buildings, built by Waterhouse, and where every possible care was taken to secure effective sanitation, with, as will be shown, one fatal exception. Besides the entrance gate, Tree Court opens into Trinity Street by the Gate of Humility, through which passes the water service supplying the new buildings only. Into Senate House Passage, Caius Court opens by the Gate of Honour, and here the water service supplies Caius Court, Gonville Court, and the Master's Lodge. The kitchens and offices are supplied by a service-pipe from the back lane, and the latrines and hydrants are supplied by a service-pipe from Trinity Lane, a five-inch town main surrounding the College on all sides. It must be borne in mind that the water of the town of Cambridge is of excellent quality, and supplied on the constant-service system. It is usual for the gyp rooms to be supplied with water-taps and sinks, but in the new buildings no sinks were permitted, the slops being taken downstairs and discharged into gratings in the open court. But—and in all vaunted sanitary arrangements we find a "but"—although the architect expressly wished to dispense with any water-closet within the building, he was unfortunately prevailed upon to allow one attached to a suite of rooms in Tree Court, occupied by one of the Fellows of the College, who was absent for a considerable part of the year, the rooms and closet being then shut up.

Now, from the previous Midsummer, typhoid or enteric fever had been prevalent in the town of Cambridge; although, except the cases at Caius College and one rumoured case at Queen's, the members of the University had an entire immunity from the disease. It was calculated that from July to December there could not have been less than 150 cases of fever; so that there was no doubt that the sewers were well charged with enteric excreta.

On October 7th a student came into residence and "kept" in a room on the library staircase, near the kitchens; his symptoms dated from November 1st. A second case occurred in Tree Court on the 15th, and three more cases in the court on the same day, and a second case on the library staircase. Thus, out of the 112 persons residing in Caius College, there were 15 cases of enteric fever, 12 of which occurred in Tree Court, one in Gonville Court, and two on the library staircase, the brunt of the epidemic falling on the new buildings in Tree Court. There was not a single case amongst the students living in lodgings, nor amongst the kitchen servants. One gyp living in the town, who waited on students in Tree Court, contracted the disease, and five cases occurred in three families of students' servants, also living in the town.

Now, in investigating this epidemic, every attention was given to infection from water-closets, impure milk, bad air from drains, etc.; but all these factors had soon to be eliminated from the inquiry. It was clear there was something wrong about Tree Court, and that something was to be traced to the water-supply. The whole of the 5 in. main surrounding the College started from a common point of the main in King's Parade; but the service-pipe leading to Tree Court did not communicate with any other part of the College. If, therefore, the water was at fault, it must occur in the service-pipe of Tree Court, and not in the town main. This *à priori* probability narrowed the inquiry into the particular water-service supplying the rooms in Tree Court only. Dr. Buchanan now thought it not improbable that there was a repetition of the circumstances described by Dr. Bloxall in his report on the Sherborne epidemic, namely, that sewage matter had been sucked into this water-supply in consequence of a vacuum having been formed in the pipes. He states: "In following up this clue, some very interesting and suggestive considerations soon appeared.

"1. As a matter of fact, most of the students' servants about the College, and notably those of Tree Court staircase, spoke of the occasional absence of water from their pantry-taps. In Tree Court two

or three servants said that after such an absence the water would come on 'with a vengeance', 'like soda-water', evidently having become mixed with air with which the pipes had become charged. The failure of water was mentioned by some servants as occurring once a month or so; by others as being more frequent; and the servant having charge of the first floor and higher floors of staircase spoke of it as a thing that happened two or three times a week. Whence the air in these pipes may have been derived, will presently be matter for consideration.

"2. Under a really constant system of high-pressure water-service it is plain that pipes could not have thus got filled with air. Perhaps a considerable weakening of pressure, not going to the extent of intermission, might have stopped the supply at high levels; and there were particular circumstances to weaken the pressure in staircase O, and these doubtless account for the more frequent lack of water here. But real intermission of supply must have occurred to account for the phenomena described; and this intermission must have gone to the extent of allowing the whole horizontal service main of Tree Court to have become emptied of water, if any hypothesis of mischief resulting from this air in the water-pipes is to be upheld; for the fever attacked every staircase of the court from N to U.

"3. Complete intermission of supply was found to have actually occurred on two occasions at least during the last term. The earlier occasion can be defined as the evening of the second day of an October frost; and thus far might have been either on October 25th or on October 30th; but other associations suggest October 25th as being the more probable of the two days; on this occasion, only the particular service through the Gate of Humility was stopped. The later occasion was when the Water Company's servants having, for purposes of pipe repair, cut off the water-supply of some half of Cambridge, there was hurrying to restore the supply in order to gain water-power to blow the organ of King's College chapel for a musical service. This fixes the date of the second known intermission at about half-past 10 A.M. on All Saints' Day, November 1st.

"4. Now, a fortnight is about the incubation time of enteric fever. A fortnight after October 25th is the date of the first attack in Tree Court. A fortnight after November 1st is the date of the second, third, and fourth attacks. And though it was known that other cases of fever kept dropping in till the end of November, the coincidence of the early fever with these ascertained intermissions

was not the less suggestive as indicating the direction that further inquiry should take."

Now, where did or could this air come from that got into the service-pipes? It could not have been sucked into the pipes laid on to the pantries, coming up from the sewers through an untrapped drain, for the simple reason that no sinks were admitted into the new buildings. Slops were thrown into a bucket, which was emptied into grids in the open court. There was left, therefore, only one source, the water-closet on staircase P. The new buildings are divided by a series of open staircases, having rooms on either side on each floor, with a gyp room or pantry common to both sides. In these rooms the undergraduates live, or "keep", as it is called in College vernacular. Now, on the first floor of staircase P, the rooms on both sides formed one suite with a water-closet, where one of the fellows of the College "kept". I know these rooms and this fatal closet well. There had been some misgivings as to whether foul air could at any time enter this service of staircase P, and an automatic valve, acting by gravitation, had been fixed to prevent backward regurgitation of air. It was proved by Dr. Buchanan that this valve did not act, and that the air freely passed through it.

As a rule, the Cambridge Water Company does not supply closets directly from the service-pipes, but through an intervening cistern or service-box; but in this particular closet it was supplied directly, and the risk was run of air from the closet passing through the valve and reaching other pipes that supplied drinking water. This closet was of peculiar construction, which I have never seen in any closet, although I have had the opportunity of inspecting very many. The diagram, which I copy from Dr. Buchanan's report, clearly shows the danger which must have been always present with such a construction. The closet-pan stands on a lead tray, the soil-pipe passing through it, with a large S bend beneath leading to the down soil-pipe. There is a small syphon bend, leading from the tray directly into the S bend of the soil-pipe, so placed that if there is no water in the small syphon bend, air will pass directly from the soil-pipe, and consequently from the town sewers into the closet chamber. Now, to avoid the danger that might occur from the water in this little syphon bend being dried up by evaporation, a weeping-pipe is led into it directly from the water-service pipe, so that, supposing the small syphon bend to be empty, sewer gases had direct communication with the water-pipe. When a real syphon action took place, which doubtless occurred in October, when the

porter, finding the water was cut off, drew off all he could from the lowest tap, the fluid in the small syphon bend must have been directly sucked into the water-service pipe.

Following out this fresh clue, portions of the pipe were submitted to Dr. Duprée for analysis, and he found nitrogenised organic matter with phosphoric acid, evidently from fæcal matter, both in the supply-pipe and the weeping-pipe. The trapping water then had been sucked into the pipes as well as air directly from the soil-pipes leading to the town sewers, in which there was a certain amount of excreta from patients suffering from enteric fever.

I think the quotation I have made from the interesting and exhaustive report of Dr. Buchanan clearly demonstrates that this epidemic arose from suction of foul water and air from the sewers into the drinking water; and that this suction took place both from syphon action of the pipes, and from a vacuum being formed in the service-pipes supplying the new buildings.

The ground plan of Caius College, which accompanied that report, will clearly show the several points of infection to which I have alluded. I need hardly state that every precaution has been taken to avoid the recurrence of such a state of things, and that since Caius College has been as free from illness as any other College in the University.

Now to refer to evidence more immediately under my own personal notice.

At Droitwich, some fewyears since, a sample of water, and aportion of water-pipe coated with a black enamel, were sent to me, as County Analyst, for chemical examination, it being thought that tar from the enamel had contaminated the drinking water, which both smelt and tasted of tar. The examination showed that this was due to the presence of coal gas in the water. I suspected suction, from the main having been turned off, and found that the engineer had, to avoid waste of water, turned off the main for some hours each night. One of the stand pipes in the town yielded water smelling of sewage. Being Medical Officer of Health for the town of Droitwich, I anticipated some cases of enteric fever would occur. There were a few cases of gastric disturbance, but these, although reported as enteric fever, did not develop the characteristic symptoms of that fever. There had been previously no enteric fever in the town from which excreta could have entered the town sewers.

In 1884 a very formidable outbreak of enteric fever occurred at Kidderminster. This town is situated in a basin-like cavity, the

business part of the town being situated close to the river Stour, whilst the houses on the hills around reach to 150 ft. above the Stour level. Kidderminster is seldom free from fever, the average number of deaths for the thirteen years ending 1883 being ten, with a death-rate of .40 in an average population of 25,500. Before any action was taken nearly 100 cases of enteric fever had occurred, and during the months of September, October, and November these increased to nearly 2,000.

Although the epidemic was pretty generally distributed through the town, it must be noted that the brunt of the attack fell on comparatively new streets in elevated situations, inhabited by respectable artisans; the oldest and most crowded streets and courts were not specially attacked, whilst the central and low-lying part of the town comparatively escaped.

The sewers and drains were seriously defective throughout the town, the house drains being equally so, the sink-traps generally broken, and sewer-gases freely admitted through them; in fact, the whole sanitary arrangement was as bad as it could well be. The closets are partially on the midden system, but there are water-closets in the newer parts of the town, the outbreak attacking both systems in equal proportion.

The water-supply is derived from two deep wells, one of which is situated on a high level in the open country; the other, though not originally intended as a town supply, is in the lowest part of the town at the sewer-pumping station, the rising main to the sewage farm passing within a few feet of the well. The supply from the upper well being deficient in quantity, that from the sewage works was used to supplement it. The whole of the water of the lower well, with a portion of the upper, is pumped into a high-level reservoir ; the water of the upper well, with occasionally a portion of the lower one, being pumped over a stand-pipe, to increase the head to the upper parts of the town.

This water not only supplies the town of Kidderminster, but the neighbouring town of Stourport and the hamlet of Upper Mytton, a portion of my Droitwich sanitary district. As the epidemic, from its suddenness of attack and general distribution, appeared to be more directly referable to contamination of the water-supply, notwithstanding the unsanitary nature of the condition of the town, and as there was no reliable evidence of infected milk, I was naturally anxious for the safety of the inhabitants of Upper Mytton. Through the courtesy of the town authorities of Kidderminster, I had the

opportunity of accompanying Dr. Parsons, the Medical Officer of the Local Government Board, in his inspection of the town, and of making myself personally acquainted with the details of the epidemic. In the first instance, the conclusion was arrived at that the well at the sewage works was contaminated by a leakage from the rising main, and this well was ordered to be closed, still further diminishing the water-supply and necessitating the shutting off of the main for a longer period. It had already been shut off for some hours daily, owing to the drought diminishing the amount of water in the wells. The number of cases of fever, however, increased more rapidly after this well was closed; this might, however, be accounted for by the increased number of centres of infection. Now, it is a remarkable fact, that although the inhabitants of Stourport and Upper Mytton had been habitually drinking Kidderminster water mainly derived from the well at the sewage works, they enjoyed an entire immunity from enteric fever, there being only two cases in Stourport and three in Upper Mytton, occurring in persons who went to Kidderminster and drank largely of the water from the Kidderminster service-pipes. It was clear, therefore, to my mind that any contamination of the water did not take place in the well, but in the pipes supplying the town; and this was further confirmed by the chemical analysis of the water of the wells, which showed a remarkable absence of organic impurity. Considering that the people in Upper Mytton and Stourport were supplied by gravitation from an open reservoir, and that the inhabitants of Kidderminster were supplied by a stand-pipe; that the brunt of the attack fell upon the more respectable houses in the higher level, where the water-taps were situated inside the houses over a sink, abundance of sewer-gases freely coming up from the sink-trap, whilst the attack was slight in the courts of the very poor, supplied by water from stand-pipes in the open air; and considering also that the defective condition of sewers, drains, and sink-traps was not of recent occurrence, but was present in other summers when no epidemic of enteric fever existed, I felt that the clue to the causation of this epidemic was to be found in a similar state of circumstances as I have described occurring in Sherborne, Cambridge, and Droitwich.

I found on inspection of the houses abundant evidence of suction going on when the main was turned off, both in the taps over the sinks and the pipes to water-closet cisterns, which I found generally empty and the ball-valve open, the same milky appearance of water charged with air, and the hissing sound of the water-taps

and closet-pipes, being both seen and heard. I must allow that Dr. Parsons, in his report to the Local Government Board, does not entirely agree with my view of the case, although he admits it may be an important factor.

This admission will be clearly shown by the following quotations from his report :—

"Owing to the insufficiency of the supply of water to meet the large demand during the past dry summer for street watering and other purposes, and to the large amount of waste which prevailed, until checked by a house-to-house inspection made in June—September 1884 (during this inspection 312 water-taps and 71 valves of water-closet service-cisterns were found out of repair and wasting water), the higher levels of the town have frequently been without water. As before described, the water-main descending from the upper well enters the town at its lowest point ; from thence the branches ascend to supply the various quarters of the borough. Hence, if the amount of water entering be insufficient to supply the demands of the town, the water does not reach the extremities of the higher branches, but stands at a level, fluctuating from minute to minute, according to the amount of water drawn from the pipes, as compared with that entering them ; in other words, drawing a quantity of water from a lower branch partly empties the pipes beyond. When the column of water in the pipes falls, air is sucked in to supply the void through any orifice that may be open, as may often be heard when a tap is turned during the intermissions. In addition to the intermissions from this cause, which occur only in the upper parts of the town, various sections of the water-system have been from time to time shut off for the purpose of making repairs or new connections. Formerly, in order to do so, it was necessary to shut off the supply to the whole of the town, but the present engineer has from time to time, as opportunities presented themselves, inserted stop-valves at different points in the system, so as to limit the deprivation of water on such occasions to a part only of the town. The stop-valve having been closed, it is customary, in order to empty the main speedily to the required point, to open a hydrant beyond the valve, so as to let the water run off rapidly. This would have the effect of causing a powerful in-draught into the upper part of the section. On the return of water after an intermission, it is frequently noticed to be milky from suspended air, and sometimes to be turbid with sandy matter, the latter possibly derived from the well, and lodged in the pipes. It is evident that if in

the upper part of the water-service any open orifice or accidental aperture chanced to be situated in the neighbourhood of any stream or foul air or collection of liquid filth, such foul matters might, during the intermissions, be sucked into the pipes, and if drawn beyond the nearest branch, might be delivered at an orifice different from that by which they had entered. In this way local contaminations of the water-service would occur, which might be the means of distributing the contagion of enteric fever from household to household. . . . . The service-taps are commonly placed over the sinks, and as the latter are often, as before described, in connection with the sewers and imperfectly trapped, it may have happened that a tap has been left open, through which air, contaminated to some extent with sewer-gas, has entered the water-pipes. Again, if a water-closet service cistern be discharged during an intermission of pressure in the water-supply, the ball-cock will remain open until the water again returns and fills the cistern. If during such time there be an in-draught into the water-pipes, the air of the water-closet will be sucked in; and if there be defective joints in the drain from the closet-pan (and such were found in some instances), this air will be contaminated with sewer air. . . . . It is more probable that if local contaminations of the water-service by reflux have occurred, it has been through accidental leakages. If a drain and a water-pipe, both leaky, lie side by side in a porous soil, the escape of water may find its way into the drain, and be carried off without showing any signs on the surface. On the occurrence of an in-draught into the water-pipe, foul matter which had escaped from the sewer might be sucked into it. That many of the drains are leaky I have already stated, and it is known that some of the older water-pipes are so. I was shown some which had been taken up, and were found corroded into holes. . . . . "

Recommendations.

"A careful guard should be maintained against any conditions that may injure the purity of the water. Search should be made for leakages in the neighbourhood of drains and middensteads, dangerous connections between the water-pipes and closets, or other places from which foul matters may be drawn into the water-pipes during intermissions of pressure. It is desirable that the number of stop-valves should be increased, so that on occasions when it is necessary to empty the pipes for the purpose of repairs or making new connections, only small sections of the town need be deprived

of water. Provision should be made, as by ball-valves at the highest portion of each section, for the admission of pure air during such unavoidable intermission. This will diminish the danger of air being sucked in from impure sources."

From the remarks I have already made I think I have shown that the suction of sewer-gases can, and does, take place, both in our houses, where the water-tap is over a sink with defective traps, admitting gases into the house direct from the sewers, and also in the street mains, from which a house that is absolutely perfect in all its sanitary arrangements may be infected with enteric fever through the drinking-water, and where, as I have before said, the inmates may literally drink the filth of their neighbours, and that this may account for those cases of enteric fever the causation of which it seems almost impossible to determine.

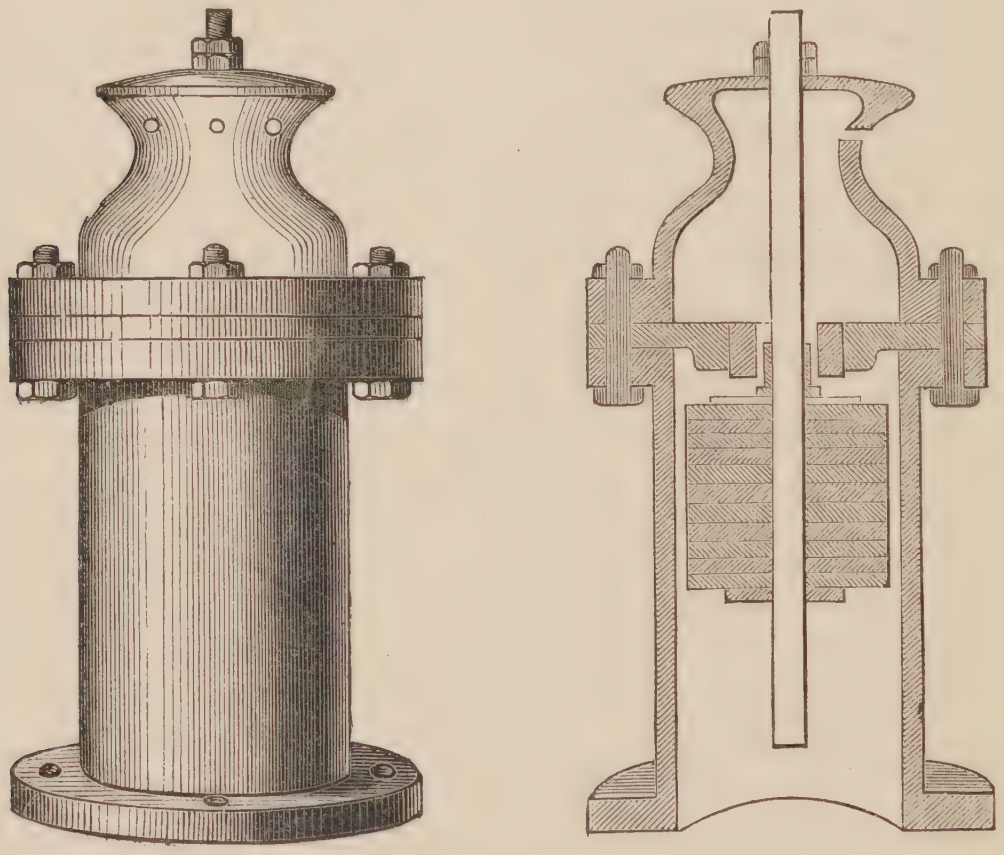
Now is there any means of preventing this danger? It seems clear that the wise provision of insisting on the water-closets being supplied by a separate service-box, and not directly from the service-pipe, is not always a sufficient protection. At Kidderminster all the closets were thus protected, and yet when the water-main was turned off, the cisterns were speedily emptied and the supply-pipes open to suction. Nor is the automatic valve acting by gravitation, as in use at Cambridge, a protection. At Caius College we have seen that this valve did not act, and air was sucked freely through it.

Thinking over this matter, I came to the conclusion that the only true protection would be to admit air into the highest point of house service-pipes and sections of street mains whenever the water-supply was turned off, and thus effectually to prevent suction, either by syphon action or by the formation of a vacuum in the service-pipes.

In devising a means of effecting this, I first proposed to construct a domed chamber, which might be filled by a T-piece to the water-pipe or main, having an indiarubber collar or diaphragm fitted inside, and a hole pierced in the top of the dome for the admission of air. A ball of wood or hollow metal, capable of floating in water, was placed in the chamber beneath the diaphragm, so that when the water was turned on the ball would float upwards, press against the elastic diaphragm, and prevent any water escaping into the street or house; but when it was turned off, and any water drawn off, the ball would sink, and air be freely admitted into the pipes, so as effectually to prevent any vacuum being formed; and if there was no vacuum there could be no suction.

Now this simple plan, although it seemed effective on paper, yet when it was constructed entirely failed. The ball was knocked down by the force of the water impinging against it, and the water burst out in a fountain. I next tried a conical metal float, and this was satisfactory up to 50 feet of head, but beyond that pressure the water made its way between the top of the float and the diaphragm, with a similar result as in the first experiment.

I then produced the valve which I show you, which, whilst freely admitting air when the float falls, entirely prevents any water escaping from the valve when the pressure is again on. These have stood trials with almost any degree of pressure that the metal case will stand, and the greater the pressure the more closely the valve is sealed. I construct this valve in two sizes: for street mains, made in iron, and for house service, in brass. I have protected them by letters patent, and they can be supplied at reasonable prices.



Swete's Safety Anti-Vacuum Valve.

The structure of these valves is that of a float surmounted with an elastic disc pressing against a metal diaphragm, a winged valve loosely fitting passing through the aperture in the diaphragm with a guiding rod to ensure its direct action.

In the street sizes, the dome is capped and the air-holes pierced under the cap, so as to avoid grit from the roads falling into the valve.

Samples of these valves are now in the Parkes Museum, where they are being practically tested by the Committee of the Sanitary Institute. I have also exhibited them at the meeting of the British Medical Association at Cardiff, and in the Museum of the Sanitary Institute, last year, at Leicester.

The large street valve I tried on a 5-inch hydrant with a fire-hose ; in taking off the dome there was not even dampness above the diaphragm. Whilst making this trial the fireman informed me that they considered the valve of great assistance to their work, as it enabled the head air in the pipe to be discharged, and gave a full stream for the nose-pipe at once.

Another advantage is found to be obtained in the use of the house-service valves, that by letting in air at the highest point it enables the pipes to be entirely emptied at the lowest tap, so as to free the pipes from water during frosty nights, and thus avoid the danger of having the pipes burst.

These, however, are side advantages, and though they may raise the commercial value of the valves, they are not the objects for which I constructed them.

If, then, these valves are placed at the highest point of the water-service in our houses, neither syphon action nor suction can possibly take place. They are automatic, and cannot fail to admit air ; the only failure, if worn out by time, would be escape of water, which would be a sufficient indication for the renewal of the float or elastic cushion ; but I am convinced they would stand several years' wear before this would take place.

In the streets, I propose that one should be fixed at the distal side of every hydrant, or where there is an apparatus for turning off the water from the main, so as to prevent any suction from street-sewers, gas-mains, or subsoil saturated with sewage matter.

Now it may be well to consider the objections I have received to this plan.

1. It is a sanitary fad ; there are plenty of other such things to be had. Well, we have seen that at Caius College the automatic valve acting by gravitation failed to act ; and I do not know of any other plan. I believe there are some taps in the market for the purpose, but one I have inspected very soon got stuck, and did not act when wanted.

2. Why not simply bore a hole in the top of the service-pipe that will answer every purpose? This was a remark made by a Medical Officer of Health. Truly, such a hole will easily admit air, but my worthy critic did not calculate on what a splendid fountain of water would be made in his house with perhaps, as at Brighton, a head of 250 feet.

3. What is the necessity of any such valve, when we have separate cisterns for the water-closets? These would not protect us from the suction in street or pantry sinks; but Kidderminster has shown us that even the separate cisterns were no protection, as they were constantly emptying, and the ball-valve open, air hissing in the pipe at almost every water-closet.

4. The *Sanitary Record* thinks it a valuable invention, but fears, unless care is taken to place the valve where there is no foul air, that such air might be absorbed through the valve.

To this objection I would state that it is not intended to place the valve inside any water-closet, but to keep it on the highest point outside such place, or any other where the air may be polluted; but even if it were placed inside, the air could only act on a very small film of water, and without any pressure; whereas in suction, air conveying with it organic matter passes through a considerable amount of water in the pipes, and all organic impurity is washed from the air-bubbles into the water, I do not think there would be much danger even from the source the *Sanitary Record* indicates, and if there were, it would be many degrees less than the original danger of suction. I must now leave the matter for discussion, thanking you for the opportunity of so fully entering into this matter before you.

The reading of Dr. Swete's paper was followed by a short conversation, in which Dr. Corfield, Dr. C. E. Saunders, Mr. Murphy, and others took part. Dr. Corfield observed that weeping-pipes for supplying the syphon under the trap were by no means so uncommon as the reader of the paper seemed to think, and he strongly deprecated the prevalent belief that a separate cistern for the water-closet was unnecessary where there was a "regulator valve" beneath the seat.

In answer to some gentlemen, Dr. Swete said that his valves were not yet in the market, but that the smaller would probably cost ten shillings, and the larger £2.

ON THE PROTECTION OF MILK FROM CONTAMINATION, AND THE MEASURES NECESSARY FOR MAINTAINING THE PURITY OF MILK SUPPLIED TO THE METROPOLIS AND OTHER TOWNS.

BY

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(*Read: Feb. 19th*, 1886.)

PURITY of the milk-supply is equal in importance to purity of the water-supply. It affects all civilised communities, for there is scarcely any person anywhere who does not take milk in some form or another. The principles that should govern milk supervision, and which we have formulated in this paper with special reference to the protection of London, are, we believe, applicable, with a few modifications according to locality, to all countries and places where milk is produced for sale.

The milk trade of the metropolis is gigantic, for it is the supply of about 500,000 households, containing four millions of souls. Up to this date the statements as to the amount of the daily metropolitan milk-supply have been based upon theoretical assumptions, and the estimates on the subject have varied from 1 oz. per head of the population up to eight times that quantity.

In 1884, one of us endeavoured to replace these imaginary and misleading statistics by more accurate data, and obtained from the railway depots, from farms, and from other sources the necessary statistics, with the following results :—

(*a*) *By rail.* The average quantity brought up by rail to all the railway stations in London which receive milk was found to be, on a day in the summer of 1884, 88,603 imperial gallons ; and on a day in the winter, 78,956 imperial gallons.

(*b*) *By road.* The deliveries to London by road that could be ascertained was a daily average quantity of 958 gallons in summer and 818 gallons in winter.

(*c*) *From London cowhouses.* The supply of milk from the cows

kept in London was found to be about 26,250 imperial gallons on a day in summer, and 21,000 gallons on a day in winter.

Taking in each case the mean of the summer and winter supply, and to this quantity adding 1,708 gallons from miscellaneous sources, the total daily supply of milk to the metropolis in 1884 was found to be as follows :—

	Gallons per day.		
By rail	... 83,779	or	76.2 per cent.
By road	... 888	or	.8 ,,
London cowsheds ...	... 23,625	or	21.5 ,,
Miscellaneous ...	... 1,708	or	1.5 ,,
Total ...	... 110,000		100

The total population of the metropolis was estimated by the Registrar-General to be, in the middle of 1884, 4,019,361, hence the average daily consumption of 110,000 gallons of milk distributed among that number of people gives a quantity per head of about 4 oz.

That the unhealthy secretion of one animal brought in contact with another may impart disease is a sufficiently ancient observation, therefore there is nothing abnormal in the fact that milk acquires, under certain conditions, infective properties.

The more, indeed, the familiar domestic aspect of milk as a fluid food is placed in shadow, and the purely physiological view of milk accentuated—viz., that milk is as much a secretion as the saliva, the tears, or the urine—the greater will be the surprise that milk, as a rule, is perfectly harmless ; but that occasions do arise in which it becomes terribly infective, is amply proved by a whole series of epidemics, in which the essential connection of the milk-supply with the epidemic has been with more or less clearness proved. It is not our intention to discuss the details of the evidence, but for the purposes of this paper we assume as an accepted fact that impure milk may be the means of propagating scarlet fever, enteric fever, and aphthæ, and that there is a fair ground for suspicion as to the occasional connection between the milk-supply and tuberculosis and diphtheritic throat affections.

This transmission of disease by milk is largely dependent on certain peculiarities of the secretion itself. For, if modern views are correct, and zymotic disease is due to the multiplication and growth of pathogenetic micro-organisms, milk, so long as it has what has been called the *amphioteric* reaction, is a fluid in which every known pathogenetic bacillus or micrococcus finds a suitable soil ; and even when moderately sour from the development of lactic and other acids, whatever

inhibitory action such acidity may have upon the multiplication of micro-organisms of a certain character, it does not destroy them. As milk is delivered for use it swarms with the seeds of bacterial life. One of us made, during 1884, many experiments having for their object the determination of the micro-organisms contained in milk. These experiments were made by enormously diluting small quantities of milk with sterilised water, and cultivating, in nutrient gelatin, weighed drops of this dilute liquid. There were two forms which in twenty-five samples were invariably present, viz., the bacterium lactis, and a micrococcus growing on gelatin plates in the form of round, pearl-like white colonies ; these, inoculated into gelatin in test-tubes, grew in a peculiar nail-like manner, or perhaps a better comparison of the fully developed growth would be to liken it to a drawing-pin, having a large flat head and narrow stem. There were a very large number of other forms in various milks, but as the above two forms were constant, it is not likely that they have any special significance. These and other micro-organisms are derived from the air of the sheds, from the cutaneous surfaces of the udder, and from the hands of the milkers ; they are found abundantly in milk but a few hours old, amply proving the capacity of milk as a bacterial soil.

The precautions that could be taken against milk-pollution and its effects may, for convenience, be grouped under four heads, as follow :

1. The precautions which should be taken by farmers and others engaged in the trade of producing and distributing milk.

2. The precautions in connection with milk which the consumer may observe.

3. The measures which may be taken for the protection of milk by utilising the machinery provided for carrying out the Food and Drugs Act.

4. The supervision that can be exercised by Local Authorities under statutory enactments specially providing for the protection of milk from contamination.

1. *The precautions which should be taken by farmers and others engaged in the trade of producing and distributing milk.*—(*a*) *Cleanliness.*—The frequent cleansing of dairies and cowhouses, the removal of manure, etc., are matters on which there is entire agreement ; but there is one urgent need in the larger dairy-farms and cowsheds, and that is, proper lavatory arrangements. In few cowsheds anywhere have the milkers any greater facility for washing their hands than what is afforded by a pail of water. This primitive

arrangement should be replaced by a row of basins and a constant supply of clean water and towels. All farmers tell you that they insist upon the milkers washing before milking ; but the actual fact is that personal uncleanliness among the milkers, from want of supervision, is common. The Danish dairy system is in this respect an example to us : in Denmark the milkers wash after milking every second cow. In the same country the udders and teats are cleansed with water. As a rule, cows have fairly clean udders, but those admitted into a shed from the fields, with their long open-air coats, often become very much fouled ; yet our milkers are so afraid of the use of water, that even when the udder is caked up with cow-dung they merely wipe or cleanse it imperfectly with straw. We certainly think that, in all cases in which there is filth on or adjacent to the udder, water should be used and the parts properly washed.

Since it is the property of the infective matters of the diseases of which we know most, to be rather preserved than destroyed by simple drying, it follows that scarcely visible traces of infected milk adhering to a churn or can would impart its pernicious properties to the whole of any pure milk placed in the can. This process would be greatly aided by the temperature of warm new milk ; for all micro-organisms which thrive in animal bodies complete their cycle of existence quickest at blood-heat. This is also true with regard to the bacterium lactis, which there is little doubt is the main cause of the "sourness" of milk. It is therefore not alone necessary to cleanse the cans, but, in biological language, to "sterilise" them. In relation to the cleansing of milk-cans, there are certain peculiarities of milk to be remembered. Milk is a fatty and albuminous fluid, and, just as in the case of blood, very hot water coagulates the albumen, so that its use may cause the adherence of a fine film of milk to the sides of the can or churn. The very best method seems to be, in the first place to wash the vessels with cold water, made alkaline by a little soda, and then follow this up with hot water, and finally submit the cans to the action of super-heated steam. The steam, rushing with force from a pipe, and directed to all parts of the inside of the churns, very effectively destroys all lactic acid ferment or other bacteria. An effectual and alternative plan is to place the churns, after being washed, in a "hot air chamber"; but this would involve more construction than the other method : and since the steaming is very generally practised in the larger metropolitan dairies, we think the sterilisation by steam is more likely to be adopted by the trade than any other process.

(*b*) *Health of Cows.*—Any perfect official system of inspection of the health of the cows would involve the employment of an inspectorial staff large enough to examine every cow supplying milk at the least once a week ; not alone because the incidence of disease is rapid and uncertain—the animal healthy one day may be ill the next —but also because of the frequent changes which take place in the stock of cows in a business of any dimensions. Such a system would be impracticable, and we would rather look to the trade itself to detect the first symptoms of local or general diseases ; but at the same time the trade must depart from many cherished traditions. A cow that eats its food, and gives a fair supply of milk, is, in the dairy-farmer's view, a healthy cow. Local diseases, such as eruptions on the udder, or even ulcers discharging matter, are not looked upon as circumstances which entirely prohibit the milk from being mixed with other milk, and sold. Of late years, the very unpleasant circumstance has been amply proved, that, as in epidemics so in epizootics, there are masked, or, to speak more accurately, very slight attacks of infective maladies, that even skilled observers may fail to detect ; and yet the infection from these abortive seizures planted in another animal may give rise to the ordinary, evident, and acute disease. It is, indeed, among the human kind that the light attacks of cholera, small-pox, scarlet fever, etc., are the despair of the Health Officer,—the diseases that obscure etiology, that baffle diagnosis, and break down all systems of isolation and quarantine. The paramount duty, then, of the dairy-farmer should be to pay attention both to apparently local maladies, especially to those affecting the udders and teats, as well as to transient general ailments ; and we would point out that it is at present a legal obligation that the milk of no cow that is suffering from any general sickness may be sold for consumption. Similarly, any local disease affecting the udder or teats, either eruptive, ulcerated, or otherwise, and attended with a local rise of temperature, must be considered to render a cow absolutely unfit to produce milk for purposes of sale.

(*c*) *Identification of Milk.*—In a perfect system of milk distribution, there should be some means by which a Medical Officer of Health—and, as for the matter of that, the consumer—would be able to rapidly ascertain from what group of cows he is supplied. This is quite practicable, nor does it involve such a revolution in procedure as might be imagined. For the attainment of this desirable object many schemes might be devised ; but the one that strikes us as immediately available, is by dividing the cows producing

the milk into groups, numbering the groups, and also, on the same principles, numbering and labelling the churns, and keeping proper registers.

The conical cans, technically called churns, used for the conveyance of milk, hold about sixty-four quarts, or eight barn gallons, and the average yield of a cow is from eight to ten quarts daily ; two-thirds of the total yield are milked early in the morning ; one-third is collected at the second milking. So that a full churn in the morning would probably contain the milk of some six or eight cows, while a full churn in the evening would contain the milk of a greater number. All that is necessary is to make proper arrangements, so that the milk of the same cows shall always go into the same churn. Take, for example, a shed containing one hundred cows: these could be divided into ten or more groups, each of the groups having a distinct number, and the churns corresponding numbers. In this way the churn labelled No. 1 would take the milk of No. 1 group, and no other. The plan followed in some places of mixing together the milk of an entire herd is, in our opinion, highly undesirable, for in this way the milk of a single sick cow may be made to infect the whole milk; whereas, in the system we suggest, the infection would be limited to the milk of the group of cows. To make the system complete, the retailer would have to keep a register of his customers and the churns from whence they were supplied,—always, of course, supplying the same customers from the same churns.

The benefits of this simple change of procedure would be great and direct. It would enable any contamination of milk to be traced to its source. If one group of customers was alone affected, it would point to the group of cows supplying those particular customers ; if the influence seemed to be generally among the customers, we should then look for some general source of pollution, such as might arise from a polluted water-supply, or from infection among the milkers.

At the present moment, thousands of the smaller milk-sellers, getting their milk at third and fourth hand, have no idea where it is produced ; and at the best managed dairies it is not always easy to ascertain even the bare fact that such and such a milk was derived from such and such a farm. The retailer would, under such a system, also obtain other minor advantages; but the fact alone that under it infection could be traced back to its source with ease and certainty would amply justify its adoption.

2. *The precautions in connection with milk which the consumer may observe.*—It is certain that heating infected milk to the boiling

point renders it harmless, so that if the consumer choose, he may drink milk from the most suspicious source with impunity; but, mainly from the want of proper appliances to heat the milk, domestic boiling gives almost invariably a peculiar taste, which limits the practice to, comparatively speaking, few households. The proper way to heat milk is in a vessel of china, glass, or earthenware, placed in a saucepan containing hot water, and protected from smoke by a cover or otherwise. Placed on a fire, the temperature of milk can be raised to boiling heat in this manner without injury to the flavour. Milk should, of course, be only kept in vessels scrupulously clean, and in an atmosphere uncontaminated by drains or other sources of atmospheric pollution.

3. *The measures which may be taken for the protection of milk by utilising the machinery for carrying out the Sale of Food and Drugs Act.*—The danger arising from the pollution of milk by impure water is more pronounced with regard to milk derived from country districts, in which numbers of impure supplies exist, than in respect to milk either produced or adulterated in the metropolitan district. Dangers to the milk-supply of this nature are capable of considerable diminution in two distinct directions, the most important of which is the methodical investigation of the water-supply of every dairy-farm by the Medical Officer of Health of each district. An active administration of the Sale of Food and Drugs Act is also valuable as an indirect preventive. With regard to this matter we would call attention to the Marylebone system, which is as follows: the Public Analyst has, for all practical purposes, the duty of carrying out the Act. He is paid by salary, not by fee, so that activity cannot be ascribed to personal interest. A register is kept of every milk-seller, and in the course of the year at least one sample, and sometimes as many as five or six, is taken by the Inspector, at uncertain times from each. The percentage composition of all the milks, with the names and addresses of the sellers, is published every quarter, together with the names and addresses of those that have been convicted of adulterating their milk, and the amount of fine inflicted. Finally, a black-list is made, not alone of those that have been prosecuted, but also of those sellers who have been working a cunning trade, and watering the milk just to the limit. The members of the black-list are very specially dealt with. The result of this systematic activity has been that adulteration of milk has fallen from 35 per cent. of the samples taken in 1883, to 11 per cent. of the 1885 samples. At the same time there is little hope that

procedure under the Sale of Food and Drugs Act will afford a means of detecting milk infected in other ways—such, for example, as by unhealthy discharges or specific excreta ; for it is, at present, not possible for the most skilled analyst or microscopist to give a decided opinion as to whether a sample of milk is diseased, unless there is some coarse admixture of blood or pus ; nor does there seem very much to expect from the new method of research. One of us last year mixed known quantities of typhoid excreta with milk, and submitted the same to cultivation. In the experiments there was a decided difference between the colonies raised from the typhoid milk, and the colonies from the pure milk ; but, apart from the *control*, it would not have been possible for the experimenter to distinguish between the pure and impure milk. No doubt such attempts should be persevered in, for some interesting facts may be ascertained, the more especially if with cultivation is combined animal inoculation ; but, apart from the scientific interest of such work, the length of time necessarily elapsing from the commencement of the experiment to the final result is so great that any application to ordinary practice, and on a large scale, is not possible, nor, if applied, likely to be effective.

4. *The supervision that can be exercised by Local Authorities under enactments specially providing for the protection of milk from contamination.*—The special legislation for protecting milk from contamination is entirely contained in the 34th section of the Contagious Diseases (Animals) Act, 1878, and in the Order in Council made in pursuance of that section, and which is called the "Dairies, Cowsheds, and Milkshops Order of 1885". This Order supersedes one made in 1879, and which was much less effective in its character. The present Order makes provision for the registration of cowkeepers, dairymen, and purveyors of milk ; but, unfortunately, it omits to require the registration of premises, so that it may be that any person who registers himself may lawfully carry on business at many places of which the Local Authority knows nothing. No discretionary power is vested in the Local Authority, who must register any person, whether he has fit premises and appliances for carrying on a milk trade or not. In addition to some general provisions as to the sanitary condition of dairies and cowsheds, the Order prohibits persons who are suffering from infectious disorders, or who have been in recent contact with persons so suffering, from taking part in a milk trade ; it prohibits milk from being kept in rooms used for sleeping ; and it prohibits the milk of a diseased cow from

being mixed with other milk, or sold or used for human food. The Order also authorises the Local Authorities under it to make regulations for the inspection of cattle in dairies ; for the sanitary condition of dairies and cowsheds ; for securing the cleanliness of milk stores, milkshops, and of milk vessels used for containing milk for sale ; and for prescribing precautions to be taken by milk vendors against infection or contamination.

These are very valuable provisions, and would go far towards giving milk that protection which we advocate, if the Executive Authority had been placed in the right hands in all cases. But the Local Authority for country and rural districts, for all places except towns, is the Justices in Quarter Sessions, and the executive arm of this Authority consists of the County Police and the County Veterinary Surgeon ! This renders the provisions of very little value except in the metropolis and in towns ; and until the Sanitary Authority is made the Authority under the Act, in the manner proposed by the Public Health (Dairies) Bill introduced by the Government into Parliament in the session of 1883, we do not look forward to valuable results under the powers given except in towns.

The Bill we refer to was, unfortunately, not passed, and has not been reintroduced ; and we suggest that it is desirable that some representations should be made with a view to its being brought forward during the present session of Parliament. Under the present Act the powers of Inspectors are very inadequate, and the Bill will be useful in that direction, as much fuller powers are provided for. The Local Authority for the protection of the milk of the metropolis from contamination is the Metropolitan Board of Works ; and the regulations that have been made under the Dairies, Cowsheds, and Milkshops Order by that Board, and which are now in force in the metropolis, are as complete as the existing powers permit. They contain detailed provisions as to the construction of cowsheds and dairies ; for securing the cleanliness of milk stores, milk shops, and milk vessels ; and they prescribe the precautions to be taken against the infection or contamination of milk. These regulations also require a milk dealer to give immediate notice of the outbreak of infectious disease on his premises, or amongst his *employés ;* and they also provide for the steps to be taken in such a case, including the prohibition of keeping milk for sale in the building until it has been disinfected and declared by the Medical Officer of Heath for the district to be free from infection. At the suggestion of the Society of Medical Officers of Health, the Board

have recently undertaken to communicate to the Medical Officer any case of infectious disease that comes to their knowledge, and they are clearly desirous of taking all measures in their power to protect milk from contamination.

At the beginning of the year 1884 there were 8,285 premises registered in London, from which milk was distributed to the public; and these consisted of 1,176 cowsheds ; 231 dairies constructed in accordance with the regulations for dairies ; 1,941 shops devoted to the sale of milk and dairy produce ; 4,421 shops at which milk and other articles were sold ; 516 dwelling-houses, without any shop, at which milk for sale is kept ; making the total 8,285. The number of registered premises is now probably over 9,000, and there have been over 22,000 registrations and transfers since the first Order came into force in 1879.

The work done by the Metropolitan Board of Works under the Act has been very useful indeed. Many of the worst of the London cowsheds have been abolished (in 1880 there were 1,044 holders of cowshed licences, in 1885 there were only 810), and the sanitary condition of the remainder has been materially improved. Although the situation and the construction of many of these places are not good, they are a great improvement upon what existed before. Cowsheds are frequently inspected, and are found to be usually in fair sanitary condition, and in accordance with the regulations. This may also be said of the dairies, which have in most cases practically been reconstructed; and the milk at milkshops and at general shops is now found to be kept, as a rule, fairly in accordance with the regulations.

When inspection was first commenced by the Board, the conditions affecting the milk-supply were frequently found to be very bad. Not only were cowsheds and dairies in a most improper condition, but milk was constantly found exposed to malign influences. Impure sources of water-supply from tainted wells have been stopped and the wells closed up ; untrapped inlets to drains have been trapped or removed, and other improvements made, not the least of which is the reformation of the sanitary conditions of the milk depots at railway stations.

A very remarkable fact, one that should be accentuated, is, that although in the past few years there have been many outbreaks of epidemic disease in London which were traced to milk, yet the strictest investigation has failed to trace the source of such disease to any one of the 1,200 metropolitan cowsheds. The infection has been

found to have taken place in the country, in sheds or places which were practically under no official control.

We suggest that, in addition to the changes already referred to, it would be desirable that some discretionary power should be given to the Local Authority as to registration. It does not appear desirable that premises should be registered until they have been made in a fit sanitary condition for the purpose. If such a power were given, the Local Authority might, on registration, give a certificate which would be some guarantee to the consumer; or, in the case of milk sent from the country into London, to the retail distributor of the milk.

It is also desirable that some sanitary control should be exercised over milk in transit. At present, such milk can be carried in unclean churns, and can be kept at railway stations or other places, where it may be affected with sewer-gasses from untrapped drains, or other contaminating influences. Although, in London, the railway companies have made the improvements suggested by the Local Authority, that may not always be the case; and we consider that some distinct authoritative sanitary supervision is necessary. The peculiar qualities of milk rendering it such an excellent soil for the preservation and growth of pathogenetic entities, and the facility with which it seems to absorb contagium, renders it of great importance that the transport and keeping of milk for sale should be carried on with the greatest care.

The system of keeping cows in sheds all the year round is gradually and surely supplanting the more natural condition of permitting them to graze in pasture; and if the cow is deprived of the free country air and mewed up in sheds, this artificial environment must be made as favourable as possible to the maintenance of health, —that is to say, in roomy, well-ventilated sheds, with every reasonable sanitary requirement. The great practical difficulty with regard to town sheds is in the supply to the cows in cold weather of sufficient fresh air for their health, and, at the same time, the maintenance of the air of sheds at a healthy temperature. This can only be done by special arrangement, and one of us has designed a model cowshed, in which a plentiful supply of fresh air is constantly distributed throughout the shed at a healthy temperature, and without draught. A shed on this model is now being completed at Balham, and the owner, Mr. Dibbin, is prepared to show it to any Medical Officer who applies to him.

It is probable that the adoption of the precautions indicated in this paper will have the effect of throwing the milk trade into the hands

of fewer people, as it might drive out some of the smaller men who have not the sufficient capital to make the necessary provision for carrying on the trade in a proper manner. The danger to the public health from contaminated milk, is, however, so serious, that it is certainly desirable that the best methods of combating that danger should be considered. There is probably little doubt that the better portion of the trade would support an amendment of the law in the directions indicated, and would also carry into practice the greater part of the precautions which we have indicated.

The suggestions for protecting milk from contamination which are contained in this paper may be briefly summarised as follows:

1. The precautions which should be taken by farmers and others engaged in the trade of producing and distributing milk should include—

(*a*) Proper facilities for the cleanliness of the milkers, as it is desirable that the hands of persons engaged in milking should be frequently washed.

(*b*) The cleansing with water before milking of the udders and teats of cows which are in a dirty state.

(*c*) The cleansing before use of churns and other milk utensils, first by washing with an alkaline solution, and then by the injection of high-pressure steam.

(*d*) The prohibition for use as human food of the milk of cows affected with any diseases, including local maladies; and the treatment of such milk in the manner prescribed by Article 15 of the Dairies, Cowsheds, and Milkshops Order of 1885.

(*e*) The adoption of a system (such as is indicated in this paper) by means of which milk implicated in any epidemic could be traced from the consumer back to the cow, or group of cows, from which it was obtained.

2. The precautions taken by the consumer may include—

(*a*) The keeping of milk in an untainted atmosphere and in properly cleansed vessels.

(*b*) The heating of milk in an earthenware, glass, or china vessel, placed in another vessel containing water; as by adopting this method the flavour of the milk is not spoilt.

3. The measures which may be taken by utilising the machinery provided for carrying out the Sale of Food and Drugs Act may include—

(*a*) The sampling and methodical testing of water used in connection with the milk-supply, where the water is obtained from sources which are, or are liable to become, questionable.

(*b*) The adoption of some such system as described in this paper, of periodically examining milk, and of publishing the results in cases of serious or persistent adulteration, as under this practice adulteration has, in the parish of St. Marylebone, decreased from 35 per cent. of the samples tested in 1883, to 11 per cent. of those tested in 1885.

4. The supervision that can be exercised by Local Authorities under statutory enactments specially affecting the protection of milk from contamination should be extended by providing—

(*a*) That registration of premises used for keeping milk for sale may be refused by a Local Authority, unless the sanitary condition of the premises is satisfactory, and unless proper provision has been made for protecting the milk from contamination, and for cleansing the milk utensils.

(*b*) That certificates of registration may be issued by Local Authorities.

(*c*) That the control of country cowsheds, and of the milk-supply therefrom, be transferred from the Justices in Quarter Sessions to the Sanitary Authority of the district, in the way proposed in the Public Health (Dairies) Bill, introduced by the Government in the session of 1883.

(*d*) That additional powers of inspection, as provided in that Bill, be also given.

(*e*) That some efficient sanitary control over milk in transit be given to the Local Authority.

(*f*) That gradual improvement in the construction and sanitary arrangement of cowsheds, and especially of town cowsheds, be insisted on.

Discussion.

Mr. Spencer then referred to the great difficulty attending any attempts at obtaining proper ventilation of cowsheds in cold weather without unduly lowering the temperature, and laid on the table plans of a model cowhouse now in course of erection at Balham from his designs. The method adopted was that which, sooner or later, must, he said, be more or less generally introduced into private

houses—the warming of the incoming air. This is accomplished by means of inlet arrangements and air-warming chambers under a portion of the shed. The air is admitted to these chambers by an open area, twenty feet long by two feet wide, and an opening in the basement wall ten feet in width by eight feet in height, which is the primary inlet, and is regulated by sliding doors. The air is then passed through a screen of coarse canvas, about eighty square feet in size, and then passes through small brick chambers, heated with coils of about 600 feet of small high-pressure hot-water pipes. There are two such heating chambers, and the pipes are heated by a Perkins furnace, on the high-pressure system, in which there is no boiler, the pipes themselves forming a coil in the furnace, in the centre of which the fire burns. This system of heating is less troublesome, occupies less space, and gives better results than most systems.

Having passed through the heating chambers, the air flows along four channels, one under each side of the two feeding paths which divide the shed. These air-channels are four feet deep at the inlet end, and gradually decrease to one foot in depth. Over these air-channels are iron gratings about ten inches wide, and the fresh warmed air passes freely into the shed through these gratings, and in front of the dwarf-head wall in front of the cows. These head walls are about three feet high, and protect the cows from the chance of draught from the gratings. It will of course only be necessary to make use of the furnace in very cold weather. At other times the air can be more or less freely admitted without being warmed. It is anticipated that the shed will be much cooler in warm weather than ordinary sheds, as the air will have to pass through the underground chambers and the coils of cold-water pipes. With a view also to the warmth of the shed in winter and its coolness in summer, the roof has been lined with match-boarding, and windows have been omitted. The lighting of the shed and its exit ventilation is by means of five large louvred ventilators, each four feet in width, three feet in height, and two of ten feet, one of fifteen feet, and two of twenty feet in length. The glass in the top of these louvres is gently curved, so that the wind is utilised to assist in the extraction of air from the shed. The louvres are movable, so that the exit ventilation can at all times correspond to the quantity of air being admitted to the shed; and the admission of air to the shed, except through the air inlet, is provided against by two sets of doors to each opening. The cubic space allowed for each cow was 1,000 feet, the actual cost of the

heating apparatus about £100, and that of fuel for the year, about £10.

Mr. Barham (of the Dairy Supply Company) complained that while a penalty was very properly imposed on any cowkeeper or dairyman knowingly employing a person suffering from infectious disease or coming in contact with others so suffering, in any work connected with the dairy or the distribution of milk, there was no clause in Acts or Orders making it compulsory on the men themselves to inform their employers that they were so affected or situated, a fact that could only be ascertained by the appointment of a medical man specially to attend the *employés* and their families, a practice obviously possible only in the case of large establishments. As to the alleged occurrence of milk-infection in country dairies only, he reminded the meeting that the first proved and now classical instance, investigated by Dr. Ballard, occurred in London; and that, after all, the London cowsheds produced but one-fifth of the milk consumed in the metropolis. He heartily approved of the suggestions in the paper, and in his own establishment they were all carried out. The question of ventilation was, he admitted, an important and a difficult one; but it was not less important in stables, which, as a rule, were very insufficiently ventilated, and this could not but exert an injurious influence on the health of the horses, and, as was too often the case, on that of the stablemen, whose rooms were so improperly placed above the stables. As to temperature, he observed that, on the Continent, cowhouses were kept, as a rule, much warmer, and consequently worse ventilated, than they were here. His own experience led him to believe that the temperature most conducive to the health of the animals was between 45° and 50°, but that a higher temperature, as 55° to 60°, induced a larger production of milk.

Mr. Joseph Smith, as a rural Medical Officer of Health, dwelt on the dirty personal habits of the men employed on dairy farms, and the dangerous character of the water-supply where the well and the cesspool were almost invariably side by side. He also pointed out the difficulties of extending Mr. Blyth's suggested registration of the source of milk to second and third-hand dealers, however useful it might be where the shop was supplied direct from the farm.

Mr. Lovett (Medical Officer of Health, St. Giles's) bore out Mr. Joseph Smith's remarks on the dangers of small ill-conducted dairy farms, and wished that the trade were centred in fewer and larger hands. He referred to a case coming under his own notice, in which

railway servants, whose families were suffering from scarlatina, had tampered with the milk in transit, with the possible result of spreading the disease, and to the case of one of Mr. Barham's men, whose child was attacked with typhoid fever, which the parents did not recognise as such, and which would never have been known to his employer had not he (Mr. Lovett) been called in. He ought to add that Mr. Barham excluded the man from his premises while continuing to pay his wages. A case, too, had come under his observation, in which a milk-carrier actually suffered from scarlatina, and went to his work unobserved the first thing in the morning; indeed, he believed that such a practice was common amongst a certain class of workmen.

Mr. Welford (Warwick Farm Dairy) believed that the leading members of the trade did their very best for the protection of the public, but agreed with Mr. Barham in the necessity for some law compelling the men to notify the existence of disease in their houses. He fully intended to try Mr. Spencer's method of ventilating and warming.

Dr. Sykes (Medical Officer of Health, St. Pancras) said that there were 365 dairies and milkshops in St. Pancras. He had visited all the smaller, and found that in many the walls were tarred instead of being limewashed, which he thought was an objectionable practice. The majority of the smaller dealers did not know whether they were registered or not, and he often met with vessels containing milk in shops along with petroleum, etc.; at others the milk was openly brought out from bedrooms, and once in a common housemaid's slop-pail.

Dr. Gwynn (Medical Officer of Health, Hampstead) referred to the sale of low-priced and very poor milk by itinerant dealers, often from other districts; and asked for information as to the veterinary inspection (if any) of cows on large farms.

Mr. Shirley Murphy said that in 1883, having seen a child suffering from scarlatina in the family of a milk-carrier (of which the employer had not been informed), he wrote to the Metropolitan Board of Works, to ascertain whether the master or the man were legally responsible, and whether the expression "purveyor of milk" could be interpreted to include a milk-carrier. The Board replied that such a case had not previously been brought under their notice, but that they would consider it. He would ask Mr. Spencer whether they had yet come to a decision. In a case in the country, in which the parents of a scarlatinal child attended to it and served in the

shop, the Court decided that "contact" implied actual bodily touch, which obviously could not be proved at any rate of the father, thus making the provision a dead letter.

Dr. Septimus Gibbon (Medical Officer of Health, Holborn) agreed with those who held the doctrine of the propagation of infection from one person to another by means of milk as a vehicle, but thought that the theory of the communication of disease from the cow itself to man was untenable.

Dr. Seaton (Medical Officer of Health, Chelsea) admitted that cowsheds in the country were, as a rule, far worse than those in London, but had found that county authorities were strongly opposed to all forms of centralisation, and would resist any interference or inspection on the part of the Local Government Board.

Dr. West observed that great obscurity surrounded the question of the mutual relation of epizootics and epidemic diseases, and agreed with Dr. Gibbon in withholding his assent to any assumption beyond the conveyance of human diseases by milk as a vehicle, by the persons of the carriers, and by contamination of the milk with polluted water, as in the case of enteric fever.

Dr. Willoughby was not prepared to accept the derivation of scarlatina from any disease of the cow without much stronger evidence than had as yet been adduced, but considered it quite conceivable that ill-defined forms of disease, quasi-diphtheric or pneumonic, and so on, might be thus produced ; while one disease proper to the cow, viz., foot-and-mouth, had been frequently communicated to children, though not positively recognised ; but Dr. Pollens, in Eulenburg's *Handbuch des Gesundheitswesens*, mentions a case in which a medical man and two veterinary surgeons having, as an experiment, drunk a pint and a half each daily of milk from a cow suffering from foot-and-mouth disease, were, on the fifth day, attacked with eczema of the mouth, hands, and feet, with febrile disturbance and other symptoms identical with those in the cow. He waived the question of the transmission of tuberculosis by means of milk, but the case of foot-and-mouth disease sufficed to prove that one form of disease at least was thus communicable as such to man.

Mr. Barham, rising again, said that an intelligent, practical foreman, such as he had at his Finchley farm, would recognise in a moment anything amiss with a cow, and separate it from the others. He explained that the ignorance of the dealers as to their registration was owing to the fact that they did not receive even a notice of the receipt of their application. He thought that a plain printed

certificate might be issued, to be exhibited on the premises. He could confirm Mr. Smith's remarks as to the juxtaposition of the well and the cesspool on many farms.

Dr. Corfield (Medical Officer of Health, St. George's, Hanover Square) thoroughly approved of Mr. Blyth's proposed registration of the source of milk; even if that from different farms only were distinguished, so much time would be saved in ascertaining the origin of infection, that perhaps half the cases in an epidemic might be prevented. In one that he had had to investigate, the source of the disease was not found until they had inspected seven of the eight farms whence the milk was supplied.

Mr. Spencer, in replying, said that what was really wanted was increased powers of inspection; the power of making regulations being fairly adequate. The Board were now endeavouring to co-operate with the vestries and local boards and their medical officers of health, and were ready to provide the latter, if desired, with copies of the registers for their respective districts. They had, it is true, discontinued their original practice of sending copies to everyone, since little use seemed to have been made of them, but full copies would be supplied to any who asked for them now, though when they remembered that the register contained over 20,000 entries they would understand that the work of making out local registers was no easy task. The law was certainly defective as regards the legal responsibility of servants, and as such unfair to the masters, but "purveyor" could not be interpreted so as to include servants and carriers. So, too, the question of contact needed reconsideration, for it had been decided in a metropolitan police-court that actual bodily contact must be proved, making the provision useless. He stated, in reply to Dr. Sykes, that tar was approved of by the Board as being hard, smooth, and impervious, which could not be said of lime-wash, and he thought that dirt was almost as easily seen on a bright black as on a white surface. He would explain to Dr. Seaton that in the Bill to which he had referred the Local Government Board was empowered to take action only in the default of the local authority; and some such provision was really necessary, since one district suffered by the dereliction of another, which made it a national rather than a local question. Among the 9,000 milkshops in London, he feared that 75 to 80 per cent. were not really suitable for keeping milk, and he considered that the local authority ought to have the power of refusing registration if the state or arrangements of the premises was not satisfactory; for other-

wise registration, especially as it at present was the registration of persons, not of premises, could be of little use. He would explain that the model cowhouse at Balham was far more expensively constructed than was necessary, being, in fact, intended for show; but a shed for twenty cows on his plan could well be built for £400, exclusive of the cost of site, and the heating apparatus and ventilation would cost perhaps £70 or £80 or more. He thought that the advantages of the system would not be dearly bought, when the improved health of the cows was considered.

REGULATIONS AS TO LODGING-HOUSES—THE SANITARY ACT, 1866.

By S. R. LOVETT, L.R.C.P.Edin.,
Medical Officer of Health for St. Giles.

(*Read: Feb. 19th*, 1886.)

In the year 1884, at the request of the Local Government Board, the Board of Works for the St. Giles District, who had previously made certain regulations, proceeded to consider the desirability of making fresh ones in accordance with the powers conferred on them by the 35th section of the Sanitary Act, 1866, as to houses let in lodgings or occupied by members of more than one family. The Local Government Board, with their communication, forwarded certain model suggestions which they urged should be adopted by local authorities.

On the 13th January 1885 the St. Giles Board of Works adopted certain regulations, which were afterwards confirmed by the Local Government Board, the first of which required the landlord of a lodging-house, or his agent, within fourteen days after service of a notice requiring him so to do, to attend at the offices of the Board, and to supply certain information necessary for the registration of the lodging-house of which he was the landlord.

In the latter part of the year 1885 the officers of the Board were directed to proceed with the registration of certain houses in Dyott Street in the parish of St. Giles-in-the-Fields, and accordingly, in the case in point, a notice was served upon the person who was the landlord of No. 18, a Mr. Willis, requiring him to attend and supply the information necessary to enable the Board to register the house as a lodging-house. Mr. Willis appears to have placed the notice in the hands of his solicitor, who at once intimated to the Board that his client did not intend to comply with it, as he was desirous of obtaining an authoritative decision as to whether or not the St. Giles Board had any power to register the house in question ; proceedings were accordingly taken, and the defendant appeared before Sir James Ingham, the chief magistrate at Bow Street, on the 28th

of January. The case on behalf of the Board was conducted by Mr. Howard Smith, barrister, instructed by Mr. Henry C. Jones, the solicitor and clerk to the Board, and that on the part of the defendant by Mr. Arthur Powell, barrister, instructed by Mr. Crowther, solicitor to the landlord. Four objections were taken to the proceedings by the defendant's counsel, Mr. Powell, as follows :—

1. That the notice in the *London Gazette* of the 21st September 1866, declaring the 35th section of the Sanitary Act, 1866, to be in force in the St. Giles District, was not proof that application had had been made to the Secretary of State to declare the section in force.

2. That Mr. Willis was not the landlord of a lodging-house, being only the collector appointed by the owner.

3. That the first regulation, viz, "The landlord of a lodging-house, within a period of fourteen days after he shall have been required by the District Board (by a notice in writing signed by the clerk to the District Board, and served upon such owner) to supply the information necessary for the registration of such house by the District Board, shall personally or by his agent duly authorised in that behalf, attend at the office of the District Board during office hours, and then and there furnish and sign a true statement, etc.," is *ultra vires*, and therefore null and void.

4. That it was not proved that the house in question was a lodging-house, the evidence being that it was a house let out in separate tenements with no resident landlord.

After discussion, the learned magistrate over-ruled the first objection, holding that the production of the *Gazette* was sufficient evidence of the application having been made to the Home Secretary to declare the section in force.

As to the second objection, the magistrate decided that the defendant was, at the time when the complaint was made, the landlord of the lodging-house referred to.

As to the third objection, the magistrate decided that such regulation exceeded the power conferred on the Board by the 35th section of the Sanitary Act, 1866, and was and is altogether null and inoperative.

And as to the fourth objection, the magistrate decided that the house in question was a house let in lodgings or occupied by members of more than one family.

In consequence of this decision, the magistrate dismissed the summons, but upon the application of the solicitor to the Board he

agreed to state a case for the opinion of the Queen's Bench Division of the High Court of Justice.

The first regulation, on which the whole vital question at present turns, was adopted almost verbatim from the Local Government Board's suggestions, and it is impossible to believe that these suggestions can have been promulgated without their being first most carefully considered, with a view to ascertaining that they were not *ultra vires*.

The St. Giles Board of Works, feeling that the difficulty which has arisen is one caused by their having adopted the regulation framed by the Local Government Board, have laid the whole facts of the case before that Board, with an expression of their opinion that it would be very hard that the expenses of testing the validity of the regulation should be cast on the ratepayers of their district, and expressing a hope that the Local Government Board would favourably consider the matter, and render them their assistance in obtaining a decision upon that point. No answer to this communication has yet been received, but it is hoped that it may be favourable. The Board have not yet decided whether, if the Local Government Board decline to assist, they will proceed with the case.

THE SANITARY CONDITION OF POOR DISTRICTS IN THE METROPOLIS, WITH ESPECIAL REFERENCE TO THEIR WATER-CLOSET ACCOMMODATION.

By LOUIS PARKES, M.D.

(*Read: March 19th*, 1886.)

Mr. President and Gentlemen,—It is with some diffidence that I venture to bring this subject before you, not being, as you are aware, a Medical Officer of Health. But the matter is one that has been brought under my notice, and that has at the same time received my very careful consideration, in my capacity as sanitary adviser to a voluntary body engaged in the improvement of the dwellings of the people; and I cannot but think that it will be of advantage to everybody concerned to have the subject brought up and discussed before this Society, with the view, if possible, of eliciting a general expression of opinion from its members on the several points which I propose to bring forward.

In considering this subject I intend to divide the paper into three parts, each containing a separate problem, for which a solution, embodying the general opinion of this Society, is, I think, desirable. They may be stated shortly as follows: First, Is it desirable that the water-closets of poor-class houses should be flushed by hand with pails of water, or should they be supplied with water from a cistern? Second, Is the law as it now stands sufficient to enable a Sanitary Authority to enforce a supply of water by cistern to a closet which is without one, in all cases and under every kind of circumstance? And is it obligatory on an Authority to undertake this duty, whenever the fact of a closet being without a water-supply is brought to its notice? Third, If the law is insufficient or too undecided in its terms, as regards the powers of the Sanitary Authority in this respect, or its obligation to enforce the powers with which it is invested, what alteration is it desirable to introduce in any fresh legislation on the subject? And with this may be included the consideration of what further powers with regard to water-closet accommodation it is desirable to furnish a Sanitary Authority with.

In considering the first part of the subject, I may say that, in my judgment, founded on a fairly wide-spread knowledge of poor districts in all parts of London, the poor are very often better circumstanced in a specially sanitary point of view, *i.e.*, less liable to the risks attending defective sanitary arrangements, than are their better off neighbours. In 90 per cent. of the houses of the poor—and I think this computation is under rather than over the mark—the closet is in a yard outside of and away from the house; there is no closet inside the house, and no sink, bath, or lavatory in or near the dwelling-rooms, with waste-pipe connected directly with the soil-pipe or drain. Drain or sewer air, if it escapes anywhere, provided the house drain is sound, escapes into the outer air in the yard or back area.* We all know what the risks are which attend defective sanitary arrangements in houses, and how they are often multiplied in the houses of the rich, where closets are situated in bedrooms, or in compartments communicating directly with the bedroom, and lavatories, baths, sinks, and overflow pipes to cisterns may all be attended with the danger of specifically polluting the air or the water of the house. Houses built more than 12 or 15 years ago, and intended for the use of the luxurious classes, will almost certainly be found to be defective, from this sanitary point of view, in one or more of these particulars, as the best forms of water-closet, the necessity of ventilating the drain and soil-pipes, and the disconnection of overflow and waste-pipes from the drains, were then but little understood and seldom practised.

In the remaining 10 per cent. of the houses occupied by the poor, in which the closet is not situated outside the house, it is usual to find this convenience in the worst possible position—on the first-floor landing, under the staircase, or in dark underground cellars. Many of these houses, which are almost invariably let out in tenements, have been in their day good houses, inhabited by a respectable or even, perhaps, by a noble family. They are large and roomy, but old and dilapidated, and incapable of being put into thorough repair, and are often perfect warrens, swarming with poor families; not unfrequently they have no yard or space at the back. In such houses it is not unusual to find only one water-closet for the use of 20 to 30 lodgers, and this situated in a cellar and without a water-supply, dependent for its cleanliness on an occasional flush by a pail

* In so many houses of the poor class has it been the custom to joint the drain-pipes with clay, that an absolutely impermeable and air-tight drain in poor districts is probably the exception, not the rule.

of water. In a recent Government inquiry into the sanitary condition of a poor parish in this city, a medical witness, describing the condition of one of these houses, said that he was informed by one of the inmates that in the morning the inhabitants, unable or unwilling to await their turn to make use of the closet, were in the habit of depositing their excreta in a newspaper, folding it up, and throwing it with its contents out of a back window. This points strongly to the desirability of strictly limiting the number of people who may use one closet. It may be found that there is no nuisance existing, as the result of excessive use, but such is at any time likely to arise; and at times of epidemic visitation by typhoid fever or cholera, it can hardly be denied that the chances of the spread of the contagion by a water-closet would be just in proportion to the number of people who use it. It is hardly fair to argue that closets at railway stations and in other public places are used with impunity by a much larger number of people. Over these there is almost invariably—and there always should be—some sort of supervision by responsible officials; but even in this case many people have a strong objection to using any sort of public closet—an objection for which there is often very good ground.

The houses which I have attempted to describe are, it is well known, utterly unsuited to be tenemental dwellings for the poor. It is not, however, with this class of house with which I am principally concerned this evening, but with those healthier dwellings—constituting a large majority—in which the closet is in a back-yard or area, or, in the case of courts, is often in the court itself. The form of closet most in use is that known as the "long hopper", a long, inverted stoneware cone, with a siphon-trap beneath, and a side inlet for flushing near the top of the basin. It is not a good form of closet, for the sides of the basin or pan become very much soiled from the excreta which drop directly on them, and the water admitted by the side inlet swirls round and round, and does not effectually flush out the trap. In course of time the glaze covering the inside of the basin becomes corroded, and then the basin cannot be cleaned by water-flushing alone, and is consequently always in a more or less dirty condition. And here, I should like to ask, cannot the manufacturers produce a glaze which will always remain resistant to the chemical action of the acids and salts contained in the excreta, and which would be therefore incapable of corrosion? Although these pans are very often found dirty or partially choked, their freedom from smell, in very many cases, if the S-bend

below is trapped, is noteworthy. There is rarely any smell like that arising from a midden-pit or privy. The water occasionally thrown down washes away the soluble matters, and the remainder left adhering to the sides soon dries and becomes inoffensive. The smell from an old pan-closet is usually much worse than that which one of these "hoppers" is capable of emitting. Of course, if there is no fluid in the trap, there may be evolved from the closet much foul air from a faulty drain or from the street sewer. Even then, under the most disadvantageous circumstances, the water-carriage system of excrement removal is superior to the midden-pit and privy systems, and the low death and zymotic-disease rate of London, as compared with some of our provincial towns, which still retain these systems, serves to emphasise this fact.

I believe the best form of closet, for use by poor people, is the "short hopper", of glazed stoneware, with vertical back and sloping front, and with a siphon-trap below. The excreta fall more into the water of the trap and less on the side of the basin than in the "long hopper", and the basin and trap are capable of being effectually flushed with one and a half or two gallons of water, especially if the water is admitted by means of a flushing-rim, with a fall from the cistern of not less than four feet, by means of a supply-pipe of not less than one and a quarter inch in diameter.

The necessity of flushing a water-closet with water by some means or other I need hardly insist on, for the removal of excreta from the dwelling to the public sewer can be effected in no other way than by water-carriage. I mention this, because I have heard it stated by gentlemen learned in the law, that a closet connected with the public sewer by a drain, but itself without a water-supply, is not a water-closet but a privy, for which a water-supply is unnecessary.

Granted, then, that flushing is necessary both to remove the excrement from the dwelling as speedily and as effectually as possible, and to keep the closet itself in a decent and cleanly state, what are the best means of effecting this purpose in poor-class dwellings?

The cistern that supplies the drinking water should not be used to flush the closet. A separate cistern is necessary, both to prevent waste of water, and the possibility of the drinking water becoming contaminated by foul air from the closet. Now, the waste-preventing cistern usually supplied to poor-class houses does not in practice seem to answer. In a large proportion of the houses where it is in use, it will be found either out of order, or to have been recently out of order. The ball-cock does not act, and no water comes into

the cistern, or the ball-cock or the outlet-valve leak, and the water runs to waste. For a proper flush it is necessary to hold the chain until the cistern is empty ; this, as it requires a little patience, is very seldom done. When the chain is pulled, the valve on the supply-pipe is raised, and at the same time the ball-cock is held up, thus preventing waste, as no more water can enter until the chain is released. A short pull by a careless person is therefore insufficient to properly flush the closet. An improvement on this form is that of a siphon-action water-waste-preventer, as a short pull will put the siphon into action and empty the cistern. This form of cistern is, however, considerably more expensive, and there is still the ball-cock with its tendency to get out of order. In very poor neighbourhoods these waste-preventing cisterns have a tendency to lose their metallic chains, or other detachable parts ; and, wherever used, they require to be treated with a certain amount of care and consideration. It appears, then, that even the best form of waste-preventer is not entirely suited to the wants of a very poor neighbourhood.

Will flushing by hand with a pail of water answer so as to satisfy all sanitary requirements ? I believe it may, under suitable conditions and with proper precautions. First, there must be a water-tap in close proximity in the yard. Secondly, the duty must be entrusted to the landlord's deputy or rent-collector in a tenement-house, or to some one person who shall become responsible for its proper performance. Thirdly, the officer of the Sanitary Authority should make an inspection, not less than once a week, and at unexpected times, to see that this duty is efficiently performed, and if found to be constantly neglected, the responsible party should be summoned before a magistrate, who should have power to inflict a fine if he considers the offence proved.

For the very poorest classes, then, who are still unfortunately so ignorant and careless, and who are likely to remain so, as long as their position and surroundings are as uncared for as they are, hand-flushings of the closets may be the best practical method that can be adopted. For those people who have some decency and sense of responsibility, flushing by cistern is more cleanly and more civilised. In this class, let us hope, will be found the majority of the working artizan and labouring classes of this city.

Large numbers of the poorest classes in London live in courts and alleys which are not through thoroughfares. Many of these have been pulled down to widen streets or to be replaced by warehouses, railway depots, or model dwellings, and many still remain which, by

reason of their age, deficient light and ventilation, and other insanitary defects, are probably doomed to destruction in the not remote future. But still there are many courts which constitute healthy areas, as regards construction, light, and ventilation ; and the principle of the court is one which is well adapted to the wants of a poor population, and to easy supervision of its sanitary arrangements by the local authority. The children can play about in the court with more satisfaction to themselves and to everybody else, and with less risk of injury to life and limb, than in the busy streets. The closets, the cisterns and taps, and the dustbin, are often—and may with advantage—be placed in the court itself, instead of each house being provided with these necessaries in its own back-yard, which in these cases is generally a very cramped and limited space. In my opinion, the trough-closet, which has been in use in many of the Liverpool courts for some years, would here find a most useful application. The range should be sufficiently long to provide a separate locked compartment for every house or every two houses, and the flushing might be effected by a Field's automatic siphon flush-tank, placed in a locked compartment, the key of which would be in the possession of one of the Sanitary Authority's servants. The tank might be regulated to discharge three or four times daily, or more often, if required, by increasing or diminishing the dribble of water entering it, and all the compartments of the range should be examined once a week by the sanitary inspector to see that they are kept clean and in good condition. There is nothing in these trough-closets to excite the cupidity of their users, so that they are well adapted for the destructive class of tenants. The only part of the apparatus which is at all delicate, and unable to withstand mischievous interference, is the flush-tank, and this being accessible only to the Sanitary Authority's servant, would be out of reach.

The prevention of waste of water, the removal of dust, the cleanly condition of the court itself, and of the trapped inlets to the drain, can all be more thoroughly cared for, or expeditiously effected, in the case of courts than of streets which are thoroughfares, and in which, consequently, every house has its own separate arrangements on its own premises. The moral and social aspects of courts, consisting as they do of little communities in which each family must be well known to the others, and in which so many opportunities of social intercourse must be presented which are wanting to the dwellers in streets, is a subject which I cannot enter upon, but which appears to me of interest to the philanthropist in connection with schemes for the rehousing of the poor.

I now come to the second part of the subject, viz., the consideration of the sufficiency of the law as it now stands to enable a Local Authority to enforce a supply of water to a closet, and the obligation resting on such Authority to enforce the powers with which it is furnished.

Section 81 of the Metropolis Local Management Act of 1855 provides that: "If at any time it appear to the Vestry or District Board of such parish or district that any house in any such parish or district, whether built before or after the commencement of this Act, is without a sufficient water-closet or privy and ashpit, furnished with proper doors and coverings, and with other apparatus and works as aforesaid, the Vestry or District Board shall, in case the same can be provided without disturbing any building, give notice in writing to the owner or occupier of such house, requiring him forthwith, or within such reasonable time as shall be specified in such notice, to provide a sufficient water-closet or privy and ashpit so furnished as aforesaid, or either of them, as the case may require"; "other apparatus and works as aforesaid", on reference to a previous passage in this section, is seen to mean "furnished as regards the water-closet with suitable water-supply and water-supply apparatus, and with suitable trapped soil-pan and other suitable works and arrangements, so far as may be necessary to ensure the efficient operation thereof."

As to the sufficiency of the law, it has been maintained (1) that the Local Authority has no power to enforce a water-supply to the closets of houses built before the commencement of this Act in 1855. Such houses, of course, constitute an enormous majority in all districts of London except the suburban. There is nothing, however, in the section quoted above to favour any such view: in fact, the section appears to directly confer the power on the Local Authority of dealing with the cases of houses built before the commencement of the Act. (2) That proceedings under this section cannot be taken unless a nuisance was proved to exist, due to the fact of the water-closet being without a water-supply and water-supply apparatus. In the wording of the section there is, however, no mention made of a nuisance existing, and this interpretation, I presume, must rely upon the assumption that it was intended by the framers of the Act that a water-closet could only be regarded as "not sufficient" when it had been proved to cause a nuisance. (3) That the Local Authority has no power to convert privies into water-closets, the decision in the case of *Tinkler* v. *Wandsworth*

District Board of Works being cited to uphold this contention. But this well-known appeal-case cannot, I think, be used for any such purpose. For here it was not a question of water-closets, connected with the public sewers, but without a water-supply, but of privies with cesspits, quite unconnected with the sewers, and in which water could not properly be used. It was decided in this case that the Local Board had power to convert one privy into one water-closet with water-supply apparatus, but could not make a general order to convert any number of privies in their district into water-closets. The question of what constitutes a privy and what a water-closet is, I think, one capable of decision only by scientific experts, and I am unaware of any difference of opinion existing in those capable of deciding, which is not in conformity with that expressed in this paper.

I am aware that very many orders have been made by magistrates in all parts of London, enforcing the Local Authority's order for a supply of water to closets without them, granting penalties where their (magistrates') orders have not been obeyed, or granting costs in cases where the necessary work has been done by the Local Authority itself; but still, I am informed that there is very little uniformity in the decisions of different magistrates even in the same courts; and in case of appeal from the magistrate's order, the ultimate decision would probably turn on the construction to be placed on the judgment delivered in the case of the *Vestry of St. Luke's* v. *Thomas Lewis*, tried in the Court of Queen's Bench in 1862. In this case the closets belonging to the defendant were without a water-supply, and the officials of the Vestry found that, in consequence of their want of water-supply, the drains were choked and blocked up, the pans filled and choked with filth, and the seats and floor covered with filth. The Vestry, through their officials, performed the necessary works, supplying the closets at the same time with the proper water-supply apparatus, and proceeded to recover costs before the magistrate. The magistrate, however, dismissed the case, on the ground that "Section 81 contains no power to convert a privy into a water-closet, by providing water-supply thereto, as had been done in this instance, but that if the privy already established was not sufficient, the Vestry should have required the respondent to make it so, and on his default, under the authority of section 81, by doing such works as the case required, and then to recover from the respondent the expenses incurred by them in so doing."

This decision was reversed in the Court of Queen's Bench. Lord Chief Justice Cockburn, in giving judgment, said: "Power is given them (the Vestry) in the alternative to order either that a privy or a water-closet should be constructed as the circumstances of the case may require"; and "it may be very proper that the Vestry or District Board should have power to direct that water should be used to get rid of the accumulation of filth." The other judges concurred. Now, in this, it was not a question of privies at all, but of water-closets without a water-supply, and on this point the magistrate seems to have gone astray. There is no doubt a nuisance existed in this case, without which probably the Vestry would not have taken action; but the Court of Queen's Bench, before whom the appeal was heard, were not called upon to determine this, it being a question of fact and not of law. The question of the sufficiency of a closet is for the Vestry or its officials to determine, and if appealed against, must, I presume, be decided by the magistrate on the evidence before him. The insufficiency of a closet need not, I apprehend, necessarily mean its productiveness of nuisance. One closet may be considered insufficient, and rightly so, for the use of thirty people, but yet it may not—so far as known—have caused a nuisance. Still, at any time it might be expected to give rise to nuisance, and in epidemic periods it would be a constant menace to the health of the neighbourhood. It still remains to be decided whether a Local Authority has power to make a general order enforcing water-supply to all or any number of closets in its district, without exercising discretion in each particular case, as is necessary in the case of the conversion of privies into water-closets.

As to the interpretations of this section with regard to the obligations which rest upon Local Authorities for its due enforcement, the following views have been propounded :—(1) That the deficiency of a water-closet in the matter of suitable water-supply and water-supply apparatus is a question of fact. If there is no water-supply and water-supply apparatus, there can be no suitable water-supply and water-supply apparatus, and the Local Authority is consequently bound to take proceedings to enforce one. (2) That the sufficiency of a water-closet and the suitability of a water-supply and water-supply apparatus is a matter for the determination of the Local Authority or of its adviser, the Medical Officer of Health. If, in the opinion of the Local Authority or of its sanitary adviser, a water-closet is sufficient which has no water-supply or water-supply apparatus, then the absence of such water-supply does not bind the Local Authority

to take proceedings under this section; or, if, in the judgment of the Local Authority or its adviser, hand-flushing by pails of water is held to constitute a suitable water-supply and water-supply apparatus, then again, there is no necessity for taking proceedings.

It may be said that the interpretation of an Act of Parliament should be left to the lawyers; but so long as it remains one of the duties of a Medical Officer of Health to advise his Sanitary Authority as to proceedings to be taken under particular sections of the Acts relating to public health, so long will it be his duty to clearly interpret these Acts to the best of his ability, and to be cognisant of decisions made in the courts of law which have established precedents. A Medical Officer of Health, it has been remarked at a meeting of this Society, must be a little of everything, and I think quite rightly, and his opinion on a point of sanitary law should be held as highly as his opinion on a purely technical matter.

By section 7 of the Housing of the Working Classes Act of last session, Sanitary Authorities in the metropolis now lie under a statutory obligation to enforce in sanitary matters all the powers with which they are provided. The enforcement of the Sanitary Acts thus rests on a somewhat different footing now than prior to August 1885, so that Metropolitan Local Authorities inclined to be negligent of the sanitary interests of their districts, can no longer rely on the purely permissive character of sanitary legislation, but should make an effort to become thoroughly acquainted with all the duties they may be called upon to perform.

The consideration of the desirability of an alteration in the law as regards the enforcement of a water-supply to a closet is a matter which I must leave for solution to the expression of opinion of the members of this Society, who are so well acquainted with the working of the Act. I think it is sometimes an advantage to have an Act of Parliament which is not too precise in its terms, leaving something to individual initiative, which in this case is that of the Local Authority, and which may be influenced by outside public opinion. In the case in point, if the enforcement of a water-supply to all closets in their districts was compulsory on Sanitary Authorities, they would be precluded from the adoption of methods which, in the opinion of their sanitary advisers, might give better practical results. But some uniformity of practice is, I think, needed in the different parishes of the metropolis; and a Local Authority which is negligent of the sanitary interests of its district should not be allowed to evade its duties by reason of an equivocal rendering of an

Act of Parliament. The Public Health Act of 1875 does not help in this matter. By section 36, a Local Authority is empowered to insist on a "sufficient water-closet" being provided for a house, but there is no clause, as far as I am aware, which deals with the enforcement of a supply of water to a closet. Many orders enforcing a water-supply have, no doubt, been made and enforced under this section, but I am unaware if any magistrates' decisions in this respect have been upheld in the superior courts.

In the metropolis, regulations for houses let in lodgings, or occupied by members of more than one family, under the Sanitary Act of 1866, may be made to include the provision of water-supply to closets in such houses. And such provisions have been included in some cases, where the Local Authorities deny their power to proceed under section 81 of the Metropolis Local Management Act. If all the houses occupied by members of more than one family were registered under these regulations, in these parishes, the practical difference in the enforcement of water-supply in these parishes, and in those which proceed under the Metropolis Management Act, would probably not be very great.

I think it desirable that Local Authorities in the metropolis should be provided with powers to enable them to erect trough-closets in courts and closed alleys, as previously described, if considered expedient in the sanitary interests of the district; and the expenses of their construction might be borne partly by the owner or owners of the property, and partly by the local rates (private improvement expenses), in a proportion which might be determined by arbitration by a Local Government Board Inspector. Lastly, it is pretty generally agreed that consolidation of the sanitary law, a simpler method of procedure for the recovery of costs and penalties by a Local Authority, and more uniformity in the decisions of magistrates, are greatly needed.

Discussion.

Mr. Shirley Murphy said that his experience in St. Pancras had convinced him that so-called pail-flushing could not be relied on; that, to thoroughly test the relative advantages of this method and of water laid on to the closet, a water-supply had been enforced in one part of that district, which was inhabited by the poorest of the occupants of tenement-houses, with a result entirely in favour of the latter, which had now been extended over the whole parish. The

apparatus was, indeed, very liable to get out of order, but by frequent inspection this could be overcome, and the poor benefited, not only from the increased cleanliness of their water-closets, but also by the inculcation of more cleanly habits.

Dr. E. C. Seaton (Chelsea) thought that all water-closets should be flushed directly by water being laid on to them, having recently inspected one area which distinctly taught that lesson. His experience of ash-closets led him to think them preferable to water-closets without water-supply. He spoke in terms of commendation of tanks on the principle of Field's flushing-tank, which he found to answer admirably. With reference to the maximum number of persons who might be permitted to use one water-closet, there should be one water-closet to twelve adults, and that two children under twelve years of age should reckon as an adult.

Dr. Pringle thought flushing by hand was preferable in many places, as the waste-preventers had occasionally to be removed on account of the water leaking away. He was of opinion that earth-closets were much better than water-closets without water, the latter being as bad as possible. The real difficulty with regard to water-closets was often the insufficiency of the water-supply.

Dr. Gwynn (Hampstead) wished to ask Dr. Parkes whether the 85th section of the Metropolis Local Management Act, so far as it related to "alteration of water-closets" could be made available for the suppression of closets in cellars. He had been consulted by the Sanitary Aid Committee as to certain closets not bad in themselves, but entirely without ventilation. He considered them decidedly unwholesome, but did not see that they could be interfered with, having been already sanctioned by the vestry, under sect. 73, when they were built twenty years ago.

In Hampstead they inspected all tenement-dwellings four times in the year, and 25 per cent. of the closets were always found out of repair. He objected strongly to trough closets, on the score of their indecency, and had found that they were too often neglected by the caretakers, who frequently delegated their duties to irresponsible substitutes. As to earth-closets, he maintained that they were quite impracticable in towns.

Mr. Furnivall (Acton) made some remards on the general insufficiency of water waste-preventers, and of a single flush to clear "wash-out" closets.

Mr. Bernays (Charlton) considered that a water-closet used in common by a number of tenants should always be outside the house,

for under such circumstances it was the duty of no one person in particular to keep it in order, and the pipe was very apt to get choked by bones or other refuse being thrown down.

Mr. Hart (Greenwich), generally found the water-supply defective, partly from the cisterns being inadequate for both domestic and closet purposes, and partly from the liability of wires and cranks to get out of order. He had once suggested to the landlord of some houses in East Street, Greenwich, to have the doors made to close with springs, each tenant being provided with a key, with a view to preclude the use of the closets by casuals and other persons, and the plan had worked well.

Dr. Iliff (Newington), thought that there was need for improvement in the form of pans and in the water-supply. He was strongly of opinion that the Sanitary Authority should have a power of veto on the position and general arrangements of the closets, as they had on those of the drains, in all houses, including even the better class, the occupants of which suffered most from typhoid fever. He was inclined to doubt the expediency of the indiscriminate substitution of mechanical for hand-flushing, which he believed to be the better method under certain circumstances. The Sanitary Authority, by a recent judicial decision, ought to concern itself only with the question of the existence of a nuisance, and not with the form of the closet. The supply of water by the Companies needed inquiry and watching, for he knew of houses being left for two whole days without any water whatever, and he held that the Medical Officer of Health, as well as the surveyor, should have the power of putting a veto on any particular closet.

Dr. West said that in Brussels no house could be built, nor any material alteration be made in existing houses, without the approval of the Board of Health, who might take any steps or enforce any arrangements for maintaining the sanitary condition of houses. He assured the meeting that this duty was not performed in a perfunctory manner, and said that Medical Officers could not do better than pay a visit to Brussels in their holidays, where they would be received with the utmost courtesy, and might gain much valuable information from the administrator of the Sanitary Department.

Mr. Cassal dwelt on the desirability of automatic arrangements for the flushing of water-closets in the houses of the poor. He was surprised to hear any gentleman speak with approval of earth-closets, or tolerate the midden system in any form.

One Local Authority at least did its duty in the matter of jerry-

building. At Ealing no drains were allowed under the houses or soil-pipes inside, and the drains had to be so laid that they might be inspected from end to end, while the sewers were ventilated by shafts at every available point.

Dr. DUDFIELD (Kensington) held that the Local Authorities already possessed full powers under existing Acts to enforce all the regulations laid down by the Ealing Board if they chose to exert them. The great want of the closets in poor districts was the water-supply, which was better in the East than in the West-end, where the constant service had made but little way. He thought that conical hoppers, so generally supplied to poor houses, ought to be prohibited altogether, and that they could be by the Authority giving a definition of a "proper water-closet" in the case of new buildings. He did not believe in hand-flushing, whether done by the tenant or by official attendants, and the Sanitary Authority could never maintain such a staff of the latter as would be required to carry on the flushing efficiently.

By the Water Companies Acts the Sanitary Authority could not demand a supply of drinking-water to a house if the cost to the Company should exceed 3*d.* per week; but since there was no restriction as regards water for closets in Kensington, they always took their stand on the latter ground, which answered every purpose.

The law was clear enough as to the powers possessed by the Local Authorities, and these powers were in themselves ample; all that was wanted were greater facilities for putting the law in action.

He did not think that Dr. Gwynn's estimate of the number of closets which required repairing every year was at all exaggerated; indeed, they were probably out of order again very soon after the last inspection; but anything in the shape of a water-closet was better than a privy in a densely peopled town.

With a constant water-service the size of the cistern mattered little; indeed, within reasonable limits it was better that it should be small, and thus the water be frequently renewed.

Sect. 73 of the Metropolis Local Management Act contained clauses providing for almost all they could want in the way of sanitary control, but the Kensington Vestry often issued orders for improvements which they had no power to legally enforce, and he must say that they were generally complied with.

Mr. LOVETT (St. Giles's) found the water-closets the greatest trouble. In his district hardly a closet was usable early in the day, and fæcal deposits were to be seen on every side. Repairs executed on

one day required to be repeated on the next, and the tenants would use the match-boarding, and even the seats, for firewood.

Dr. CORFIELD believed that even long hoppers, objectionable as they were, could be kept fairly clean by hand-flushing. Such he had found to be the case in the town which he had to inspect in consequence of an epidemic of scarlatina. But the difference between that town and the districts described by the previous speakers was that there the closet belonged to but one family, whereas here it was common to many, who felt no individual responsibility or interest in its condition.

Both in Islington and in his present district he had found the 73rd section of the Metropolis Local Management Act sufficient for all practical purposes, and had never failed to get costs after neglect of notices. The Public Health Act, however, was less peremptory or satisfactory, and made no mention of water-closets. As to the form of closet-basins, he said that there were several patterns which he considered left nothing to be desired as to efficiency or price; the only difficulty was the introduction of such into existing houses.

He felt compelled to dispute the argument of one speaker as regards the better class of houses, whose occupants should be expected to look after their own interests, the duty of the Sanitary Authority being to help those who could not help themselves; and as to the state of things described by Mr. Lovett, he would say it was the fault of their circumstances rather than of the people themselves.

Dr. LOUIS PARKES thought it greatly to the credit of Mr. Murphy that it could be said that there was not a closet without water in the whole parish of St. Pancras. He could not agree with those who recommended ash-closets, but felt that in a compulsory constant service we should find a remedy for most of the evils of which we complained; and he would suggest the introduction of some system of *automatic* flushing; and he saw little objection to trough closets if divided, as he assumed they would be, into compartments. He agreed with the President in attributing the habits of the poor to their circumstances.

He doubted if under sect. 73 an Authority could prescribe any particular form of closet either in new buildings or in replacing those in existing houses, but should like to know whether closets in cellars could be condemned under sect. 85.

DR. KOCH'S GELATIN-PEPTONE WATER-TEST.

By PROF. G. BISCHOF.

(*Read: April 16th*, 1886.)

We have repeatedly been painfully reminded of the fact that chemical analysis may fail to indicate danger in samples of water, when it exists in its gravest form. The occasional discharge by a single man into millions of gallons is beyond the reach of chemistry, whilst the experience at Caterham and Redhill a few years ago proved that any specific virus in the discharge may be the cause of an epidemic. The search for such virus amongst the organised living matter is therefore of supreme importance, and the biological water-test proposed by Dr. Koch, opening a prospect of success in that direction, was received by many who had been engaged in the examination of water as a delivery from the uncertainty surrounding this important branch of laboratory operations. How far has it realised our expectations?

The test gives two indications, the number of colonies, total and liquefying, formed by the "centres" or microphytes contained in a sample of water, and a microscopic examination. No reference is generally made in reports to the latter. I have examined many hundred different samples, subjecting the test also to numerous experiments, and now beg leave to submit the following conclusions:

1. The number of colonies agrees in most cases very closely in parallel tests of the same sample. Dr. P. Frankland and I made independent tests for three months of the total colonies in the supply of the several Metropolitan Water Companies. This embraced nearly fifty samples, with the result that we both assigned to each company almost precisely the same place, showing the close agreement even in the hands of different operators.

2. In comparing different samples, those which have a like history, which therefore are in fact alike, are almost always readily recognised as such by the number of colonies, but any difference in the treatment to which samples may previously have been subjected may entirely upset all attempts to draw correct conclusions from that number. To make this clear we will suppose that water is

passed from one and the same source in an otherwise precisely like manner through two pipes. The question arises, whether an infiltration of sewage takes place into one of them, and we test samples of the water which has passed through each pipe. If we find a like number of colonies in both, there is in all probability no such pollution. But, should the pipes be subjected to different temperatures, and the water in one of them become cooler than in the other, or should there be any material difference in the time of transit in them, the conclusions drawn from the number of colonies may be misleading. We have therefore in the first instance to consider the conditions upon which the development of microphytes and thereafter the number of colonies depend.

Temperature is perhaps of the greatest influence, because development is entirely suspended near the freezing point, and accelerated to a most extraordinary degree as gradually 30° to 40° C. are approached. From this it appears clear that, as far as the number of centres is concerned, a deep-well water with 12° C. cannot be strictly compared to a river water with, say, 2° C.

The food required by microphytes for their development is derived from all and every kind of matter of organic origin, as also from a variety of compounds of inorganic nature. The leaves which fall into a river, the natural hay-infusion carried into it in the autumn, the manure washed into it, various mineral salts derived from rocks or otherwise, everything is their prey, and may greatly influence development. A few drops of a sterilised solution of sodic phosphate added to a sample of water will make a striking difference in the number of colonies obtained by culture ; in fact, we must recollect that the multiplication of microphytes is not as much limited by their power of propagation as by the conditions surrounding them. One single bacterium termo, Professor Cohn has told us, might, under sufficiently favourable conditions, fill up the entire ocean in less than three days with its progeny.

The following experiments were made with a view of ascertaining the influence of time or storage upon the number of colonies, it being self-evident that all samples, which we may test, have undergone some kind of storage.

(*a*) New River water, which would have been styled "very good" by Dr. Koch had it even contained twice the number of colonies found, was kept for six days in my laboratory in a sterilised flask, protected against aerial contamination. The result was a gradual increase of microphytes from day to day by self-multiplication from

1 liquefying, or a total of 53 colonies, to 640 liquefying, or a total of 770,000 colonies per cubic centimètre. The latter figure is seventeen times in excess of the total colonies found in a sample of Thames water, which I took a few months ago at London Bridge, the liquefying colonies also comparing unfavourably. This proves the predominating influence of storage when compared even with such a relatively polluted water as that of the Thames at London Bridge.

(*b*) After adding to the above sample of New River water one per cent. of sewage, which had been filtered through paper, the total colonies increased almost six hundred times; whilst, after keeping this mixture for six days, side by side with the pure water (*a*), the colonies in the latter exceeded those in the sewage-tainted water almost twenty times. This result is probably analogous to the well-known experience that in brewing fermentation is shortened by the addition of yeast. At all events it proves the possibility that a sample in which many less colonies have been found than in another may be the more polluted.

(*c*) The flasks in experiment (*a*) had been protected by ordinary plugs, which are known not to give invariable security against the penetration of microphytes. To exclude the possibility of any such error, a number of pieces of one-inch glass tubing, each about three inches long, were drawn out at both ends to a fine point, sterilised and filled to about one-third with a water in which twenty-seven liquefying, or a total of 290 colonies per c. c. had been found. The ends of the capillary tubes being sealed before the blow-pipe, the samples were transferred to a cultivating chamber, and kept at about 18° C. After six days the liquid in one of the tubes contained on the average of four closely agreeing tests, 8,400 liquefying, or a total of 21,000 colonies per c. c. The liquefying colonies were from the beginning largely preponderating as compared with those in the first experiment, and after culture they were forty per cent. of the total colonies, against about 0·1 per cent. in the first experiment. This probably is the cause of the comparatively slight increase of other colonies. After a total of twelve days' culture the colonies showed a decrease to 1,300 liquefying, or a total of 6,400, and after twenty-two days to 880 liquefying, or 1,700 total colonies. After forty-four days' culture the liquefying colonies had decreased to eighty-three, the total colonies being the same as after twenty-two days, viz., 1,700. The experiment is being continued.

(*d*) I have, lastly, traced the influence of storage, as indicated by

the number of colonies, on the water in a clean slate cistern supplying my laboratory. During the recent cold weather, when the New River water feeding the cistern had a temperature of 5° C., seventeen liquefying, or a total of forty-nine colonies, were found in it, whilst the water drawn from the cistern in the usual way, which had a like temperature, showed a total of 127 colonies per c. c., but no liquefying colonies. When the supply had reached a temperature of 11° C. it contained thirty-seven liquefying, or a total of 880 colonies, whilst the water drawn from the cistern as above, having a temperature of 11½° C., contained twelve liquefying, or a total of 1,544 colonies. The liquefying colonies had therefore, under the circumstances, decreased in both experiments, whilst the total colonies increased two to three times. I thought it interesting to ascertain, in connection with the above experiments, the relative bacteriological purity, or rather the number of colonies, when withdrawing water from the bottom of the cistern in the usual way, and two feet higher up (about two inches below the top level). In some instances I obtained a very considerable increase of colonies at the bottom, in others an almost like increase at the top, and again in others no practical difference between the two samples, but the liquefying colonies were always, sometimes very considerably, in excess at the top. This behaviour probably depends essentially upon currents in the water, when its surface is cooled by a depression of the temperature, and upon the relative quantities of water which are withdrawn from the top and bottom. The liquefying colonies appear to be more independent, selecting the top strata, perhaps on account of the oxygen there constantly absorbed from the atmosphere. The feed-water was introduced in some experiments, as usual, at the top, in others at the bottom of the cistern; in the former case, contrary to my expectation, the colonies at the top showed the greatest reduction. It may not be without importance, if these indications should lead to some simple mechanical arrangement, allowing of the withdrawal from cisterns of a water containing fewer microphytes than with our present appliances, as such reduction would be likely also to extend to any specific disease-germs which may have entered the water-supply.

The development of microphytes is, lastly, influenced by the proportion of free oxygen present, and of light or darkness. We know that the enormous microscopic growth in certain waters can be checked by exclusion of light. In order to keep the influence of light distinct from that of storage, parallel samples of water were mixed in the usual way with gelatin-peptone, spread on glass plates and cultivated

with and without exposure to light. When light was excluded, the total colonies were, on the average of six experiments, reduced by about one-third, as compared with the samples exposed to light. A distinct excess of colonies, when cultivating in darkness, was observed in one case only.

3. The preceding observations have laid a foundation upon which we may build up our argument concerning the reliability of the gelatin-peptone method as a hygienic water-test. Organic carbon and nitrogen, ammonia, nitric and phosphoric acid, chlorine and other bodies met in potable water, have all in their turn been employed as analytical standards, because they point to something, or at least are supposed to point to something, which is or may be injurious to health. *The number of colonies, excluding for the present specific germs of disease, can likewise claim significance only, if they bear in some way an invariable, or at least practically invariable, ratio to wholesomeness.* It must either be shown that they themselves follow a like rule as chemical poisons, being harmless in some numbers and hurtful in others ; or, second, that they are an indication of something else which is injurious.

Absence of colonies, which happens but rarely, may safely be taken as a sign of exceptional purity, excluding at any rate recent pollution of a sample. A few colonies probably justify a similar conclusion, but we do not know where to draw the boundary. Taking the other extreme, as many as 770,000 microphytes per c. c., and, may be, many more, are evidently *per se* not necessarily an indication of unwholesomeness, otherwise this would have been observed on board ship, where water frequently has to be stored much longer than six days, and under much more unfavourable conditions than in my experiment. Should this argument not satisfy anyone, I can give still another. Mix the gelatin in one of your test-tubes with sterilised water, spread on a glass plate, and expose this for an hour to the air of your laboratory. The gelatin, after culture, will, in all probability, exhibit the appearance of what is assumed to be a very inferior sample of water, both in numbers and kinds of colonies. With every breath we draw in those microphytes, and however pure water may be, we wash them down when we drink it. This again shows the impossibility of condemning a sample simply and solely because it contains a certain number of colonies, although this may exceed more than a thousand times the number ordinarily found in potable water. On the other hand, it is equally impossible to mark 770,000 colonies per c. c. as permissible, though specific germs

of disease may be absent, for this would mean, as we have seen, that Thames water from London Bridge, or a sample actually mixed with one per cent. of sewage, is, as far as bacteriological purity goes, very considerably within the boundary.

But the number of colonies ordinarily found in cultured samples of water may, perhaps, be an indirect indication of danger, being in some ratio to the liability of the introduction of pathogenic microphytes by polluting matter. Let us, then, inquire whether some of the conditions at least upon which we found the development of microphytes to depend, have an invariable connection with pollution.

Temperature, storage, and light have obviously no such connection whatever. Highly polluted waters are, as a rule, not as well aerated as pure waters, but if the deficiency of oxygen has, under the circumstances, at all an influence on the development of microphytes, it would check it. We would therefore find fewer colonies in a highly polluted water, or the reverse of what we ought to arouse our suspicion. Food, the only remaining link to establish a connection between the number of colonies and pollution, is unquestionably the result of the latter in the widest sense; but let me remind you that even the scanty traces of food in distilled water suffice sometimes for the development of comparatively very large numbers of microphytes. Practically speaking, there is, in this case, no pollution whatever, and, going a step further, the "very good" sample of New River water contained a sufficiency of food for, at all events, as many as 770,000 colonies per c. c. If we take that quantity of food as an indication of so serious a pollution that we must condemn the sample, very few potable waters will remain which have not to be condemned; or, if we pass it over as insignificant, very few will not pass muster. How, then, are we to proceed? No doubt the number of colonies and food or pollution bear, perhaps in the majority of cases, a direct ratio to each other, but we have no means of knowing whether or not this holds good in any given case.

4. Although we may be unable to accept the number of colonies in testing water indiscriminately as the standard of either wholesomeness or pollution, that number may, in a variety of inquiries, give most useful and reliable indications, if applied judiciously. Some such instances have already been referred to, and they could be largely multiplied. But, even in such a simple experiment as the purification effected by some filtering material, it is conceivable that the number of colonies found may largely be due, not to a deficiency in

the action of the material, but to its power of retaining water. It is not easy, under any circumstances, so to wash a filtering body that every trace of the water added, say, on starting the experiment, has been renewed. Unless the material is absolutely antiseptic throughout, any microphytes in the water so retained would at once start a multiplication similar to that in the New River water kept for some days. The flow of water supplies an abundance of food, and a portion of the progeny being carried along with it, the filtered water may compare unfavourably as regards numbers of colonies, and yet these may be of as little significance as in those samples of New River water. Here, again, absence of colonies in the filtered water, or a very great reduction, gives more conclusive indications than an increase.

If I, as a chemist, may venture to express an opinion on a purely biological subject, I would further mention that the vitality of some microphytes is apparently increased by the separation of others. The lowest forms of organisms have, amongst themselves, the same fight for supremacy or existence which we find amongst the highest. This is indicated by the experience of M. Pasteur, that the virus of hydrophobia loses its virulence when decomposition sets in. Dr. Koch is of opinion that bacteria of putrefaction may likewise exterminate the comma bacillus; and Professor Arnaldo Cantani has had experience tending to show that inhalations of a rich culture of bacterium termo in gelatin are destructive to the tubercle bacillus. In this way considerable complications may arise, if we attempt to draw conclusions from the number of colonies; for, speaking under the correction of the specialists here present, the conqueror—if I may use that term—may be more prolific than the conquered microphyte. In that case a separation of the one can actually result in an increase of colonies; and if we assume, as in the above instances, that the conqueror is harmless, the conquered microphyte hurtful, such increase would mean an important sanitary improvement of the water.

5. A careful and systematic microscopic examination of the colonies found, which is scarcely within the province of a chemist, is an important aid in drawing conclusions from their numbers. Such examination is, however, incomplete without pure culture of the colonies in appropriate media. The controversy about the identity of Dr. Koch's comma bacillus is fresh in the memory of all who take an interest in such matters. Dr. Koch has told us that a precisely similar microphyte, as far as appearance under the micro-

scope goes, was mistaken for the comma bacillus, and that the two can only be distinguished by the application of *three tests*—viz., the microscopic examination and culture both in gelatin and on potatoes. This surely does not apply only to the comma bacillus, but also, more or less, to other microphytes ; and the reliability of our conclusions appears the more diminished, the less the colonies present in proportion to the total can, in the course of laboratory work, be subjected to such rigorous tests. In extraordinary emergencies—say during an epidemic—hundreds, or even thousands, of colonies may be scrutinised by a staff of experts in the examination of a water ; but even if all this has been done, I ask you, is our knowledge of the pathogenic microphytes, which are the cause of zymotic disease, sufficiently advanced, to make sure that we may not pass over a culprit as harmless ? The picking out by chance of some pathogenic microphyte would be important, but can scarcely satisfy the demands of hygiene, for amongst hundreds of harmless colonies a hurtful one of similar appearance may escape notice. Those pathogenic microphytes, which cannot be cultivated in gelatin-peptone, are entirely lost to observation, unless other cultivating media be employed. Another difficulty which occurred to me is, that the microscopes at present in use do not reach a large portion of the inner field of the cultivated plates. There important colonies may escape detection, and it seems desirable so to alter the microscopes or the glass plates that the whole field of the latter can be scrutinised. Dr. Koch considers that the suspicion attaching to the numbers of colonies is enhanced, if many different *kinds* are present, but I have not seen a single report containing a reference to this criterion, nor do I know how to apply it. It is not unfrequent that not even the numbers of liquefying, but only those of the total colonies are given.

6. The difficulties pointed out above would largely disappear if means or conditions could be suggested allowing of culture of pathogenic microphytes more or less to the exclusion of others. For instance, some probably harmless microphytes do not thrive without light, whilst pathogenic microphytes cannot be dependent upon light, or the animal body would not be their favourite nidus. I have, therefore, proposed to Dr. Koch that it might be useful to take advantage of my experience herein referred to, and lay down the rule that all cultures in testing water be made with exclusion of light.

I confess I am one of those who based very sanguine expectations

on the gelatin test, which I hoped would prove an important aid in the work I am engaged in. Great is my disappointment in finding myself unable to trust to it implicitly; the greater, as I thus find myself in opposition to a man whose achievements in hygienic research stand as high as those of Dr. Koch. But were his time and thought not more than fully taken up by pathological work of the greatest importance to mankind, I feel assured he would long ago have advanced the same line of argument which I, I am afraid in a very imperfect manner, have placed before you this evening. As it is, I must draw the conclusion that the number of colonies ordinarily found in water has no necessary or invariable connection with wholesomeness or pollution. Such a connection may or may not exist in any given case, and we have no means of deciding whether the one or the other applies. The detection of pathogenic microphytes by microscopic tests, including pure cultures, would be of great importance, but is limited by our knowledge of those microphytes. In fact, although the test is most useful in special cases, I am of opinion that it requires development in the hands of biologists and pathologists, before chemists can attempt to draw from it generally applicable conclusions. I have extended my inquiries for many months to regular reports on the metropolitan water-supply, but unless fallacy can be pointed out in my experiments and arguments—which would give me the greatest satisfaction—I do not think it would serve any useful purpose to further continue them.

Discussion.

Mr. Wynter Blyth had for more than a year made bacterioscopic examinations of waters, and had found that in comparatively still waters, as rivers and canals, the greatest number of colonies were obtained from the lower depths, whereas in sea-water they were most numerous nearest to the surface. In water kept in vertical tubes their distribution was more irregular than in Professor Bischof's observations on cisterns. He would suggest, as an explanation, that in the Regent's Canal, where most of his experiments were made, and which was virtually an open sewer, there was a constant precipitation or deposition of solid matters going on which carried down the bacteria. In the sea, on the other hand, their preponderance near the surface might be due partly to the high specific gravity of salt water and partly to the greater oxygenation of the water as compared with that at greater depths. The practical value of the pro-

cedure must, however, he thought, be looked on at present as an open question. No sensible analyst would now think of determining the quality of a water by any single fact, any more than a physician would diagnose diseases by a single symptom. Analysts must take every fact and indication into consideration—the ammonia, nitrites, nitrates, chlorine, phosphates, etc.—and the results of bacterioscopic examination, stating the conditions under which it was made. He had a very poor idea of "one-factor chemists", and it was, he maintained, premature to condemn bacterioscopy judiciously employed as a part, and a part only, of a complete examination. He would specially call the attention of water analysts to a paper by Neufville, who had examined the waters at Wiesbaden, separating and making pure cultivations of the different forms of bacteria in a manner worthy of imitation. Neufville found that heating to 65° C. for thirty minutes destroyed the vitality of the liquefying bacilli, and we might hope in time to be able to distinguish pathogenic from other forms. He had himself made experiments with milk to which a small proportion of enteric stools had been added, and though he had not been able to detect Gaffky's, or to identify any single bacillus as that of enteric fever, he could always distinguish cultivations from the contaminated milk by the presence of bacilli not found in the pure milk. But many of Professor Bischof's remarks were of great value, especially those on the influence of the exclusion of light.

Dr. KLEIN observed that many persons had at first entertained high hopes as to the results to be obtained from the new method, and Dr. Percy Frankland and Colonel Sir Francis Bolton had furnished most elaborate reports to the Local Government Board.

Referring to Professor Bischof's paper, he remarked that the excess of bacilli in the surface-layers of a liquid was a fact familiar to all bacteriologists. All those forms which were possessed of motility rose to those regions where the oxygen was most abundant, the presence of oxygen being essential to their motility, and most liquefying bacilli were mobile. But not only were we unable in all cases to distinguish pathogenic from non-pathogenic organisms under any circumstances, there was the further difficulty that many pathogenic forms could not be cultivated in gelatin. Thus, Friedeborg, examining the water of Geneva, found that samples, which with gelatin-peptone gave only 5,000 colonies to the cubic centimètre, yielded no fewer than 150,000 when broth was substituted. Yet Dr. Percy Frankland asserted that pepton-gelatin would show the presence of all, except the tubercle, leprosy, and the hypothetical bacillus of

syphilis. Dr. Klein would offer him twelve well-recognised pathogenic species, some of which would, while others would not, grow in gelatin; and the same with many pathogenic-microphytes. There was a micrococcus present in the saliva of most persons which absolutely refused to grow in gelatin.

The organism of the disease which prevailed at Hendon in the winter of 1884-85 could be cultivated in gelatin but very slowly, and that of foot-and-mouth disease took many days to grow, and would do so only when no other forms were present. Even Koch's comma bacillus was soon crowded out by Finkler's, by the bacillus of anthrax, or by that which caused the conversion of urea into ammonia. In mixed cultivations it was impossible, nine times out of ten, to recover any given form, however familiar. The only absolute test of the pathogenic nature of an organism was the experiment *in corpore vivo;* but then the difficulty presented itself that some, and perhaps the most important as regards many, failed to produce the like of any disease in the lower animals.

Mr. Cassal said that, remembering the attitude assumed by the biologists a year ago towards the chemists, he had listened with no small satisfaction to the story of their discomfiture. He alluded to the paper read by himself and Dr. Whitelegge before this Society, in which they showed that the biological test gave only evidence of a very doubtful character in addition to that which we had already from chemical methods of examination. He and Dr. Louis Parkes had made a series of experiments which fully bore out the experience of Professor Bischof as to the development and multiplication of bacilli under the influence of time and light, as well as of exposure to the air. Medical men not trained in laboratory work were, he feared, too often wanting in the scrupulous cleanliness requisite in chemical practice. Water analysis had of late been much discredited by its being performed by amateurs—he meant by men who had had only two or three months' previous instruction. He was surprised at Professor Bischof's reference to the Caterham case. He and Dr. Whitelegge had criticised Dr. Cory's experiments, and had shown that he was not justified in assuming that the enteric stools were uniformly distributed through the entire water-supply, but that, on the contrary, they were probably concentrated in a portion only, in which their presence would have been recognised by chemical analysis as sewage pollution, and that that water would have been condemned by any competent chemist. He referred humorously to Wigner's scale as a totting-up of bad marks for the benefit of men who were

incapable of taking in a comprehensive view of the general characters of a water, and condemned all conclusions drawn from single facts. He believed that either Frankland's or Wanklyn's processes, taken in conjunction with the estimation of chlorides, nitrates and nitrites, phosphoric acid, etc., was sufficient for all practical purposes, though chemists ought to be able to employ biological methods, for he entertained something like contempt for those chemists who knew nothing but their own particular department of science.

Dr. CORFIELD, in proposing a hearty vote of thanks to the reader of the paper, called especial attention to the observation that the New River Company's water, after having been kept six days, exhibited seventeen times as many colonies as that taken from the Thames at London Bridge, and also to our inability to distinguish pathogenic from non-pathogenic organisms. But, with regard to the hopes expressed by Mr. Blyth, he was sanguine that they might be realised when the subject was taken up by men like Dr. Klein, familiar with the appearance and habits of the various pathogenic organisms.

Professor BISCHOF, in replying, observed that Dr. Corfield had anticipated all he had intended to say. His remarks about the Caterham epidemic had been based upon Dr. Thorne Thorne's report. Like Dr. Klein, he had no wish to reject biological methods altogether, but rather to point out the fallacies at present incident to them. He was fully impressed with their importance, but did not consider them sufficiently reliable as at present proposed. When we considered that it was not a question merely of £ *s. d.*, but one involving the lives and health of thousands, nothing that could bring any light to bear on the subject ought to be neglected.

ON THE WATERS DERIVED FROM THE BAGSHOT BEDS, CONSIDERED AS DRINKING SUPPLIES.

By W. EASSIE, C.E., F.L.S., F.G.S.

(*Read: May 21st*, 1886.)

When you did me the honour of asking me to furnish you with a paper upon some subject which might prove of interest to the members of the Society, I decided that, perhaps, a short paper upon the peculiarities of the waters derived from the various Bagshot formations might prove interesting, if not to all the members, then at all events to the Medical Officers of Health who reside upon this geological formation, which in the south of England has, at least, a superficial area of over 300 square miles.

The Bagshot series of geological formations is now definitely relegated to the middle beds of the Eocene period of the Tertiary formation, and they occupy exclusively the whole of the middle Eocene division. The Bagshot series is very variously placed in respect of the beds which range above it in various parts of the country, but with that we have nothing to do this evening. I have, however, shown upon the plan, and included in the section, some of the deposits which were antecedent to the Bagshot series, and thus take in, for the most part, the Isle of Wight with the Pliocene crag.

Neither are we concerned this evening with the beds beneath the Bagshot series, further than that they rest upon the London clay, which, with the Woolwich and Reading beds and the Thanet sands, now form by themselves the lower Eocene division. Of the London clay and its adjacent beds and water-supply this paper can take no notice, as the Bagshot formation will be sufficient to occupy our attention to-night.

The middle Eocene is compounded of the whole of the Bagshot series of sands and clays, in the following ascending order :—Lower Bagshot ; Bracklesham beds ; Barton clay ; and Upper Bagshot.

I have not found it necessary for our present purpose to attempt any differentiation of the Bagshot formation, by way of depicting the various beds, because the geological surveys are many of them

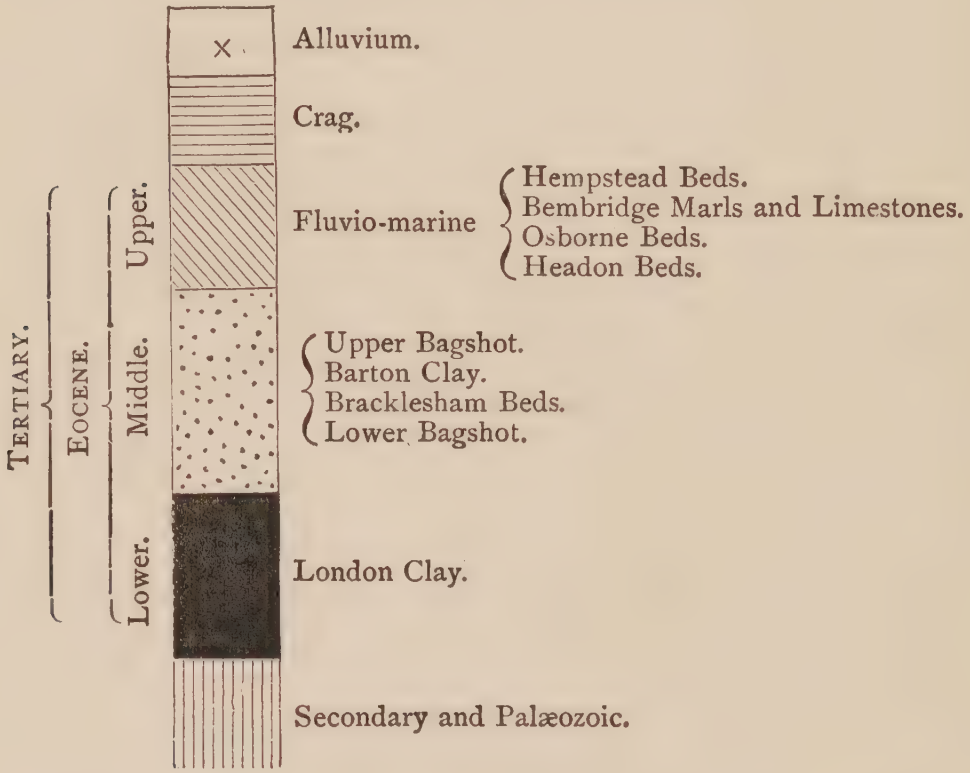
wrong; and besides, to do this for lecturing purposes, one would require a map of about four times the size of the one which I have drawn. This map gives the whole of the Tertiary system, and is drawn as the section; the Bagshot beds are shown by the spotted zone.

The bulk of the Bagshot series extends eastward from Claremont to Strathfieldsaye, and southward from near Farnham to Wokingham. On this formation are found some of the most beautiful hills and the most charming spots near Weybridge, Chertsey, Egham, Farnham, Claremont, Oatlands, Virginia Water, Sunninghill, and many other places. All the beds have been found to contain fossils, but the various sands contain but few. It would be almost useless to attempt to correlate any of the middle Eocene by means of their fossils, the Barton clay excepted, which is very fossiliferous.

The Lower Bagshot sands which lie conformably on the London clay may be described as composed of light-coloured sands of varied origins, with occasional thin beds of flint pebbles and pipe-clays, and their thickness may be averaged as 130 feet. These lower beds sometimes contain beds of green sands, but these are not to be found in these beds at Virginia Water, Woking, Claremont, or Ascot. An outlying thin layer of these beds caps the London clay, as, for near examples, at Hampstead, Highgate, Harrow-on-the-Hill, and other places. (See A, B, C, on plan.)

Beds of fine clays of various colours, from white to brown, are often found in the upper portion of these beds, notably at Woking, Horsley, and White Hill, Egham. These upper sands present the most varied characters, and are frequently replaced by almost pure clay in the west. There is, however, mostly a sandy layer where these upper beds repose upon the London clay.

The Bracklesham beds, named from the remarkable strata at Bracklesham Bay in Sussex, underlie the Barton clay in the Isle of Wight and elsewhere, and these beds consist of layers of green sands, dark clayey sands, and foliated brown clays. In Alum Bay, Isle of Wight, solid beds of lignite are found. The Bracklesham beds may be averaged at about 100 feet in thickness, but cannot be mistaken for other beds. They range from Bracklesham Bay to near London, and determine the position of the Barton clay.



Between the Bracklesham bed and the Upper Bagshot is the Barton clay-bed, which immediately underlies the Upper Bagshot sands, which can be seen in Alum Bay, Isle of Wight, and near Lymington, and is well exposed in the Barton and Hardwell cliffs in Hampshire. It attains a thickness of over 200 feet. It was formerly considered to belong to the London clay, but that error has been corrected, and now, with the Bracklesham beds, it forms the Middle Bagshot series. This clay is used for brick-making.

The Upper Bagshot sands lie upon the Barton clay, where it has not been thinned out, and form the upper and main body of the Bagshot series. They are exposed in the heaths at Bagshot, Hartford Bridge, Sandhurst, and more so in the ridges of Frimley and Chobham, where they reach over 280 feet in thickness. It is very difficult to discover the stratification of this series, because there are very few clayey beds, such as occur in the Lower Bagshot sands. There are, nevertheless, some sandstones in the upper bed, below the drift-gravel. These sands are largely used for glass-making. The surface of these upper beds is very barren, save of heath.

Taking the Bagshot series as a source of water-supply, it is always admitted that they are situated, as a rule, at too high a level to admit of any constant collection of water. In these sands the rain-water falling upon them at once permeates them, and unless it is retained by the various drift and gravel-beds, it is given off by the central clay-beds in the Bagshot series, or at the commencement of the London clay.

The first attempt to collect water from the corresponding Bagshot formation in France was made, in 1810, by a Commission named to inquire into the water-supply of Versailles; but the water collected was found to be insufficient in quantity. In 1850, it was estimated that the supply of the Bagshot Heath area of silicious sands, which is 150 square miles, or 96,000 acres of surface, would be able to supply the whole of London, if collected in catch-water drains on the top of the London clay, stored into covered reservoirs, and conveyed by a covered aqueduct to London. But it was estimated that if the yearly rainfall was 24 inches, not more than one-fiftieth of the rain that fell could be collected and supplied, owing to the loss by exposure and absorption, and by other causes. But the rainfall is variable at all times, and in 1840 no rain fell over this area from the 1st of May until the 15th of August, except a few paltry showers.

It has been admitted by the best authorities that the supply of water derived from the Bagshot sands would have been insufficient to satisfy the population of London, even in 1850; and considering the increase of population since then up to the present time, it was a wise thing not to have spent the money upon the scheme when it was first elaborated. In speaking of the water derived from the Bagshot series, I refer to the collection of water from springs thrown out at the various clay-beds of the series, or procured from wells, and I will therefore confine myself to a description of the waters

thus procurable. There is no doubt that plenty of water is stored in the Bagshot series, and the question now is simply of their purity.

It is admitted by all scientists who have made the purity of water-supply a study, that the presence of the acids which represent the products of vegetable decomposition greatly determines the suitability of a water for potable purposes. The result of my own researches into the quality of the waters derived from the Bagshot series goes to prove that all the beds are contaminated with vegetable matter, in a more or less forward state of decomposition.

We will now consider the suitability of the various Bagshot beds as a supply of household water, reversing the order I used in describing the beds. I will now deal with them in descending order.

It was stated by Mr. Woodward that the Upper Bagshot beds of white, light yellow, and other sands contain "few traces of organic remains". But since the publication of this work, ten years ago, the beds nave been more critically examined, and it has been proved that, although isolated patches of the upper beds may yield remarkably pure water,—soft, and with mere traces of mineral matter, and which does not take up iron in solution from iron pipes,—yet there are other districts which are, more or less, loaded with decomposing vegetable matter.

The Rev. A. Irving, F.G.S., last year instanced a case of extraordinary purity of water, derived from the upper sands in the well at Finchampstead Rectory, which is about 50 feet deep, and its purity is at once ascribed to the absence of any vegetable matter in solution in the water. Last year I came across a similar instance myself, at a well sunk at Castle Malwood, near Lyndhurst, in Hants, the new country seat of the present Chancellor of the Exchequer. The well, in this case, was sunk into an outlier of the upper Bagshot sands, of no great depth of section, and this patch of the Upper sands rested on a vastly extended bed of Barton clay. The Upper Bagshot sands are, however, in many instances, loaded with vegetable matter in solution. When at Wellington College, Mr. Irving showed me the well from which he derived his water, and this well, which penetrated into the Upper Bagshot sands only, was, nevertheless, greatly charged with vegetable matter in solution, and therefore it took up such a great amount of iron, especially when heavy rains succeeded to drought, that the water became unfit for potable uses. After the well, which is 17 feet deep, was for a time disused, the water was putrid, and resembled

bog-water. He could come, therefore, to no other conclusion than that this was due to the shallowness of the well and its proximity to some ancient forest lands and adjacent peaty and vegetable matter covering the sand.

With regard to the waters derived from the Middle Bagshot beds, the Lower Bracklesham beds in the Isle of Wight, besides being remarkable for the thick beds of lignite which they contain, they show on the clay-beds following the lignite, according to Woodward, a stratum of clay with evident plant-roots. In the Barton clay, which is very fossiliferous, the flora and fauna correspond with the London clay. The purer waters descending from the Upper Bagshot sands do not appear to be contaminated to any extent by these Middle Bagshot beds; nevertheless, if Mr. Irving be correct, the sands in the neighbourhood of the lignite are invariably coated with green, olive-green, and other coloured matters. In opposition to the opinion of some professional engineers, who consider that this green was iron in a "low state of oxidation", Mr. Irving contends that the green matter is the result of vegetable contamination. I think it may be accepted as proved, that the presence of lignite and fossil vegetable remains in the Middle Bagshot beds render these beds, especially the lower strata, very objectionable water-collecting media.

Speaking now of the Lower Bagshot sands, it was from Professor Geikie's *Text-Book* that Mr. Irving obtained the first clue which led him to what he believes the true explanation of the green colour of certain sands, in the Middle and Lower Bagshot series. He states in his paper, given in the *Geological Magazine* of September 1883, that after separating the sand from the clayey matter in conjunction with it, that he found the sand consist of mere surface-drift, or little more than mere rain-wash, and he considers that the green colour of these sands is due to the decomposition of vegetable matter from rank vegetation and peaty deposits, and he has always found that, under peaty deposits, the green colour of the surface-sand is always observable. This gentleman has, for several years, made persistent investigations into the causes of the generally objectionable character of the waters derived from the Bagshot sands. He came to the conclusion that the water derived from the bright, ferruginous sand, such as exists in portions of the Upper Bagshot sands, if not contaminated by forest litter, etc., at the surface, will yield pure water, revealing no deposits after standing, and that wells on the estate occupying the same geological horizon show the merest

trace of vegetable matter. The water derived by sinking into the deeper beds, contaminated by decaying vegetable matter, deposits ochreous and organic matter, and is generally unwholesome, tasting like water from a morass. In some cases the cottagers will go nearly a quarter of a mile, and convey home surface-stream water, rather than drink from their house-wells. Its obnoxious character is due to the presence of the green-coloured sands and clays charged with carbonaceous matter in the Bagshots; and the deeper the shade of green, the greater the vegetable pollution. Mr. Irving has not been able to discover a single grain of any green mineral, and he finds that the varying shades of colouring matter on the grains of sand exist only as an incrustation upon them.

To continue the subject, we may say, Mr. Tite stated, in 1850, that Virginia Water, which is collected from the Bagshot Heath, was deeply coloured with peat. Mr. Irving mentions that in a villa residence near the Wellington College, there is a well the water of which is derived from the Middle Bagshot, which cannot be made to furnish good water, despite every means that have been tried.*

As to the purity of the water which is drawn off at beds of clay underlying a bed of Bagshot sand, which shows no seam of green or dark green sand, I can give a striking example out of my own practice within the last two years. On the top of the hill overlooking the town of Lymington, Hants, is an estate, the large mansion of which I have just drained into irrigation-beds, and supplied with water from a new source. The well in connection with the mansion was found, on analysis, to be contaminated, but this contamination did not necessarily point to infiltration of sewage. This house-well was of considerable depth, and, I believe, must have derived its collection of water from impure beds through which the well had been sunk. I may say that a great portion of the estate in the immediate vicinity of the house consists of ornamental fish-ponds, more or less shallow, derived from the surface-beds, and this factor might have assisted in the disqualification of the water. Having been asked to discover a new supply, which should be beyond reproach, for the house, stables, and so forth, I examined a section of sands some little distance from the house, and noticed that water percolated strongly some 20 feet down, where there existed a thin bed of clay. I sank, a little distance from the cliff, a collecting-tank for the waters,

* This statement was made before Mr. Irving's patent filtering process was brought out.

which proved to be absolutely pure, and fitted up pumps worked by a gas-engine, when an ample supply of this pure water was obtained for all purposes. No layer of green-coloured sand was visible on the cliff, or encountered in excavating the collection-tank down to the bed of clay which held up the water ; and I have come to the conclusion that Mr. Irving is right, and that these beds of green sand will account for the unwholesomeness of the water. Since then I have had a well dug in the Bagshot beds near Eversley, Hants, and in digging it no green beds alternated, and the water, after careful analysis, was pronounced remarkably pure. I may here mention, that the flora of the Album Bay leaf-beds is full of vegetation ; and Mr. Bristow, F.R.S., states that remains of lofty fig-trees are common in the zone. The same beds contain lignite seams, and similar plant-remains have been found in these upper sand-beds at Bournemouth and Poole. At the latter place, the Rev. Mr. Clutterbuck stated, in 1850, that the Bagshot sand at Poole was so charged with disagreeable ingredients, extracted from the peat, that it became almost valueless for culinary purposes.

Taking everything into consideration, I think it may be assumed that although many of the Bagshot beds are capable of furnishing a supply, more or less abundant, of water fit for dietetic purposes, yet there are other strata in the same formation which secrete and supply waters unfitted in their natural state for potable use. This granted, it follows that every supply of water derived from any of the Bagshot series, and especially from the middle and lower beds, should be carefully analysed ; and the deeper the source of supply, the greater the necessity for analysis, for certain evident reasons,—want of nearness to oxidating powers, and the like.

A knowledge of these facts induced me to choose this subject for my paper, because so many Medical Officers of Health reside upon the area of the Bagshot beds, that I felt it would not be supererogatory to draw attention to the supreme importance of examining all waters derived from this source before recommending them.

I was informed by a gentleman, only a few days ago, that the use of a contaminated supply derived from the Bagshot beds had ended fatally, and that a medical attendant was certain that the death was primarily due to the impure supply. I will give an instance out of another geological formation, and simply to point out the absolute necessity of having waters examined by some competent authority before diagnosing the cause of illness—always supposing the sani-

tary arrangements were proper—or before building a house upon a new site in the country. I will here mention a case which occurred within the last month. A gentleman consulted me as to the adaptability of a large extent of land, beautifully situated on the slope of a hill, and everything possible in respect of prospect and aspect, for a proposed residence and offices, near Oakham, in Rutlandshire, and I advised him to have the water pumped from a trial-well, and examined by a professed analyst. My own impression was, looking at the character of the strata which had been thrown out, that they formed a portion of the rock bed which usually divides the lower from the upper lias clays. Professor Wanklyn's report to me is, that "this water is exceedingly free from organic matter, but its mineral constituent is much too high, and it is not suitable for general domestic use." You will admit this, when I say that there were 105 grains per gallon of solids, and that the hardness was over 70 degrees. My client will therefore not build a house upon this estate until I have obtained suitable water, and this I hope to do from a bed of sandy clay which I know to interpose between the lower and upper lias.

May I interpolate here a few words, to the effect that it is not necessary in such cases to excavate a well, but to tube it. Of course the "Abyssinian tube" is fit for shallow surface-waters, which are always more or less impure. Again, what is called the "Driven tube-well" cannot always penetrate certain soils at a great depth. I make use now of the "Artesian bored-tube", which enables a number of springs to be reached, allows the rock to be examined, the quantity of the water to be gauged, and the purity of each bed of water to be ascertained, as well as its temperature. This last-mentioned system of tube-boring is invaluable in deepening wells, because the tube can be brought up to the surface, and water pumped without intermixture with the water in the condemned well.

To return to the Bagshot beds. After this, I hope not useless digression, I may say that I had intended to have entered upon the question of the action of these Bagshot waters upon iron and other metals, but I felt this to be of secondary consideration, and that the chief matter was the purification of the water, so as to render it suitable for drinking purposes. Neither do I think it necessary to refer to any of the geological sections of wells, although I have a number of them in my possession: it would only take up useful time in referring to the many variations in these sections, and the remarks would be more suited to an association of geologists.

Seeing that vegetable matter undergoing decomposition may still

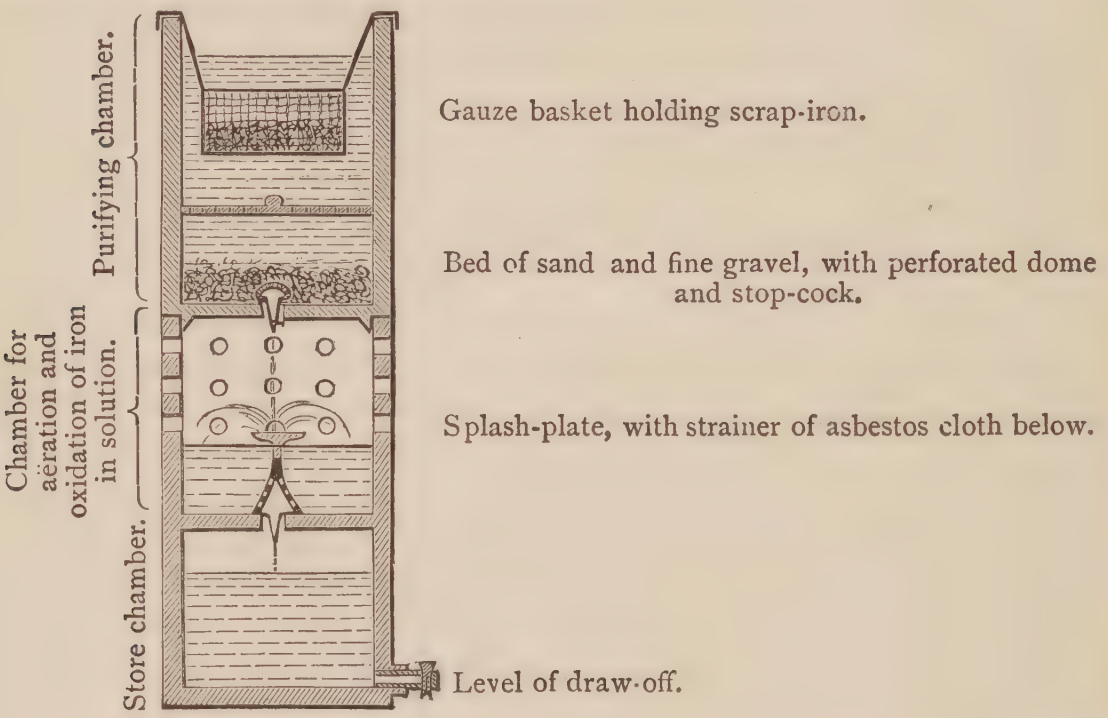
remain in solution, after all suspended matter has been removed by mechanical filtration through any ordinary filter, the question remains, how to remove this decomposing vegetable matter which is retained in the water in the shape of certain acids. These acids would disappear if there was sufficient oxygenation in an open reservoir, but the process would be a very long and tedious one. And the question with which a Medical Officer of Health would have chiefly to deal would be, how best and quickest to convert unmistakably impure water from the Bagshot beds into a soft, pure, and sparkling water, free from an iron or vegetable taste, and comparable only with the purest spring-waters derived from the fissures of primitive rocks; and the main question which I have chosen to deal with to-night is not that of how best to purify the water of a town, but how to deal with the domestic supplies of a house, situated in the midst of a sparsely populated district, where everybody is dependent upon his own well.

Without becoming invidious, I may say that I believe there is only one system of filtration extant which will thoroughly remove all the objectionable matters in solution, as well as all the visible suspended matters, and that on such a quick scale as to be able to supply the daily wants of a household in respect of potable water. I have drawn this filter in section on the diagram before you, and it is the invention of the Rev. A. Irving, B.Sc., B.A., F.G.S., of Wellington College. I saw this filter first at the International Inventions Exhibition, and it attracted my attention so much that I have since seen it put to practical trial, and know that it will redeem the character of any objectionable water derived from the Bagshot beds into a water which shall be absolutely pure.

Its working action is as under; and as no one can better explain its action than the inventor, I quote his own words, merely adding, that I know from actual observation every word of it to be correct :—

"The filtering apparatus may be constructed of either iron or earthenware, and should be capable of holding from ten to twenty gallons of water, so as to allow a sufficient period of exposure of the water to the air for its complete oxygenation, and for this reason the filter is kept open at the top. The apparatus contains three chambers, separated from one another by horizontal diaphragms. In the upper chamber the water is exposed to the air, and a wire-gauze basket, filled with iron-borings, nails, or any form of iron fragments, is suspended in the water. This facilitates the renewal of the iron

from time to time. The ferruginous precipitate formed in this chamber is retained by filtration through a bed of sand on shingle kept in its place by a perforated earthenware plate. The construction is such that the water passes slowly into the second or middle chamber, where it drops upon a splash-plate, and thus gets fully oxygenated again, air being freely admitted through a number of holes in the wall of this middle chamber. Here the last portion of iron in solution is precipitated as peroxide, and filtered off by a strainer of asbestos cloth, through which the water passes into the third or lowest chamber, where it is stored, and from which it is drawn off by an earthenware tap as it is required."



I should add that any cast or wrought-iron chippings, which can be had almost for asking at any foundry or iron-fitter's, will serve the purpose. It is incredible how quickly these iron fragments become slimed over with the ochreous, ferruginous deposit precipitated from the water as the vegetable acids, which have previously dissolved the iron, are decomposed into carbonic acid and water. When they have become very much coated with deposits they should be thrown away, and replaced with fresh fragments of iron, taking care that these are free from paint, enamel, Brunswick-black, and the like. This system of filtering by means of iron is not to be confounded with the spongy-iron or any other process, as exposure to the atmosphere is here an important factor. I have not the slightest pecuniary interest in the system which I mention, and merely in-

stance it as well worthy of your attention, as being the only one which has satisfied me. The process can be carried out on a large scale for the purification of water from dissolved vegetable matter in moorland or lake-water for the supply of large towns.

I have now completed the few remarks which I intended to make this evening, and I trust that the time occupied in the recital has not been thrown away.

Discussion.

Mr. Wynter Blyth considered the paper open to exception in many ways, but chiefly that it contained too much assertion. He did not believe in crenic, apocrenic, and humic acids, bodies which belonged to an ancient and obsolete chemical nomenclature.* They were only obtained, or said to be obtained, after the evaporation of large volumes of water, and there was no proof that they existed ready formed in the water as such, and were not formed in the process of evaporation by the action of heat on organic matter. He himself had never found a water giving an acid reaction, except from the presence of sulphuric acid formed by the oxidation of the sulphides in the pyrites of the Devonshire mines. Acids were extremely rare in natural waters, and he entertained great doubts as to any action exerted on iron by these hypothetical vegetable acids. Much was said about vegetable matter in solution, especially in the form of what was called peat, but unless fragments of characteristic vegetable tissues, spiral, lacticiferous, etc., could be detected by the microscope, it was better to speak of it as simply organic; indeed, bacterial agency would soon reduce it to the indeterminate forms commonly described as organic matter, the origin of which could not be affirmed or distinguished as animal or vegetable. The filter described by Mr. Eassie might be a good one, but no proof or evidence had been advanced that the water was thereby rendered really pure, or that it would remove from the water the specific poison or bacilli, if it were such, of, say, typhoid fever. Clearness and palatability were no proofs of purity; we ought not to be content without complete analysis of the water before and after filtration, microscopical examination of the residue, and cultures in gelatin, though he still maintained even analysis could not distinguish between organic matter of animal and of vegetable origin. The geological formation had con-

* Mr. Eassie only incidentally mentioned these old names for acids, and they did not appear in the text of his paper.

siderable influence on the nature and amount of the saline constituents of a water, but as regards the risk of pollution, in any case the only practical difference between different soils was that of their relative poverty or imperviousness. One porous soil was just as likely to permit of the passage of pollution from cesspools, for instance, as another, and from this point of view sands were no better or worse than chalk. In short, the danger of pollution of a water-supply depended on the physical characters of a soil, and not on its chemical composition, or its geological formation as such.

Dr. Sykes (St. Pancras) asked if Mr. Eassie had tried the Pasteur-Chamberlain filter, which was, he thought, more simple, and most effective.

Dr. Corfield (St. George's, Hanover Square) said that he had had some experience ofthe waters from the Bagshot sands, and had found that they varied very much. In many places the pollution was derived from external sources, and due to the poverty of these beds, as Mr. Blyth had pointed out, but it was not so in all, and especially the green sands. These dissolved iron, and acted energetically on iron pipes. In one case in which he had been consulted, the water dissolved iron, lead, zinc, and even tin-lined pipes—the lead with extraordinary rapidity. It was most difficult to know what materials to recommend for the cisterns and pipes. For the former, glazed earthenware or slate could be used, but for the pipes he had at last fixed on wrought-iron coated internally with Dr. Angus Smith's bituminous varnish. The pipes must, however, be freshly made, for the coating would not adhere to such as had lain some time in stock. As to the precise nature of the solvent in such cases, he thought Mr. Blyth had misunderstood the reader of the paper.

Mr. Eassie, replying, said that he adhered to every statement he had made, it being a subject to which he had devoted many years of study. In spite of Mr. Blyth's criticisms, he maintained in such "peaty" waters there were organic acids which dissolved iron. English chemists might have discarded the names of humic, crenic, and apocrenic, but Mr. Blyth should know that the Germans recognised and distinguished many such organic acids, which, though their formulæ might be imperfectly determined, and their place in organic series as yet unascertained, were none the less realities. Alluding to the President's remarks on Dr. Angus Smith's preparation, he said that for larger and cast-iron pipes it was excellent, and he made great use of it; but he had not employed it in pipes of such small bore, for which he should certainly prefer the Barff-Bower

process. Indeed, if Dr. Corfield could succeed in entirely covering the interior of these small pipes with the solution, he would be the first who had done such most useful work. In an entire service, cast-iron coated with Angus Smith's varnish for the larger, and wrought-iron subjected to the Barff-Bower process for the smaller, and afterwards coated inside, would apparently be perfect.

Mr. MURPHY begged to refer to the recent occurrence of lead-poisoning at Sheffield, where it appeared that the water-supply was derived from two sources, both of which were peaty and contained iron pyrites, but the one was acid to litmus paper and the other not, the former coming from an area where there was a more abundant development of peat; the lead-poisoning was confined exclusively to the parts of the town supplied from the former, which alone was found to dissolve lead.

Dr. CORFIELD, in answer to Dr. Sykes' inquiry, said that the problem in the case of the Bagshot waters was to deprive them of their property of dissolving iron, and that this could be effected only by first saturating them with iron and then precipitating the metal by reducing it to the insoluble oxide, which was done by aeration.

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